UNDERSTANDING DIMENSIONS OF TRUST BETWEEN OLDER ADULTS AND HUMAN OR ROBOT CARE PROVIDERS

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UNDERSTANDING DIMENSIONS OF TRUST BETWEEN OLDER ADULTS AND HUMAN OR ROBOT CARE PROVIDERS

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To Icarus

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SUMMARY

As the number of older adults in the US increases, the need for care providers, both personal care attendants and robots, for older adults will also increase (Ortman, Velkoff, & Hogan, 2014). Understanding how to develop trust in the relationship between older adults and care providers is important for maintaining a dyad that works effectively. Trust is a construct that changes based on context, task, and relationship (Dinç & Gastmans, 2013). Some of the factors that influence human-human trust are personal characteristics of both the person trusting and the person being trusted (Mayer, Davis, & Schoorman, 1995), and the relationship in which trust is being formed (Couch & Jones, 1997). Reflective of human-human trust, the dimensions involved in human-robot trust are personal qualities, robot qualities, environmental qualities, and design and training (Sanders et al., 2011).

Trust has been studied in several contexts, but not specifically with older adults and care providers in personal care tasks. To gain knowledge of how dimensions of trust in human-human and human-robot dyads interrelate we conducted semi-structured interviews and administered questionnaires to: (1) gain insight into the factors that influence older adults' trust in human and robotic care providers, and (2) clarify how the factors that influence trust differentiate for human-human versus human-robot relationships in the context of older adult and care providers..

The older adults interviewed in this study discussed three main categories of factors that they perceived as supporting trust in human and robot care providers: professional skills, personal traits, and communication. For both the human and robot

care provider, older adults discussed previously identified factors as well as emergent themes from this context.

For the human care provider, previously identified themes such as general capability, reliability, benevolence, and values. However, there were also new themes such as the human care providers attitude towards the task and manner of dress that emerged as important to the older adult.

For the robot care provider, older adults discussed aspects such as general capability, predictability, and reliability, that were all previously identified as contributing to trust. Some themes that emerged within the older adult-robot care provider context were benevolence of the robot, the material or texture of the robot, and whether or not the robot had similar values.

The findings from this study showed that there were differences in the themes for the human and robot. Personal traits were higher for the human than for the robot.

This study showed that while previous models of trust encompass many of the factors that support trust within this context, they are not sufficient. Within these personal care tasks, older adults emphasized not only the importance of the task being performed properly, but also emphasized personal traits and characteristics albeit less for the robot than human. Participants also frequently discussed communication and how the care providers could use communication to support trust. These findings expand what we know about trust within the older adult-care provider context and can be used to advance the training of human care providers and the design of home robots to help improve the lives of older adults.

CHAPTER 1. INTRODUCTION

The population of older adults is increasing in the United States and is expected to be almost 84 million in 2050 (Ortman, Velkoff, & Hogan, 2014). The World Health Organization recently published a report that highlighted the need to develop interventions for older adults that target individualized issues in this aging population (2015). A current intervention that allows older adults to age successfully is personal care providers. In 2011, 82.4 percent of the approximately 5 million people who received home health services were 65 years or older (Harris-Kojetin, Sengupta, Park-Lee, & Valverde, 2013). Along with an increase in older adults, the need for care providers will grow. To maintain successful older adult and care provider relationships, we must understand the elements, such as trust, that contribute to positive interactions.

Care provider is a broad term that can encompass both humans and robots. One type of care provider is a personal care attendant (PCA) who assists with a range of tasks such as bathing or housework. As the geriatric population increases so quickly, it is unlikely that all of the assistance needed can be fully provided for by human caregivers. In addition, certain tasks performed by caregivers are also physically demanding and often require two caregivers for one task (such as toileting, bathing, and transfers; Beer, McBride, Mitzner, & Rogers 2014). Robots have the potential to help assist in these tasks, not only to reduce the number of caregivers needed, but also to help protect the caregiver and older adult from physical strain when an additional caregiver may not be present. Technologies and robotics are already being developed to help fill this gap and provide assistance for successful aging. However, before deploying robots into homes of

older adults, it is important to understand successful human-robot interaction (HRI) in this context.

This relationship can be vital for older adults to age comfortably as the tasks the caregivers assist with are important for either personal health or to maintain a sanitary environment (Harris-Kojetin et al., 2013)**.** Trust is an important aspect of both human-human relationships and human-robot interaction. To help maintain an efficacious relationship between older adults and their providers, we need to understand trust in these dyads: human-human and human-robot.

1.1 Human-Human Trust

Trust is dynamic and can changed based on a variety of factors, and, therefore, resulting in a need to be studied in diverse relationship contexts (Dinç & Gastmans, 2013). Human-human trust is defined as the "willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (Mayer, Davis, & Schoorman, 1995, pg. 712). The establishment of trust is influenced by: (1) the qualities of the person who is trusting (Evans & Revelle, 2008), (2) the qualities of the person who is being trusted (Mayer et al., 1995), and (3) the type of relationship in which the trust is needed (Couch & Jones, 1997). Communication is an additional aspect that is important in trust, but the exact role that it plays in the building or establishment of trust is not well understood (Giffin, 1967; Nienaber et al., 2015; Zeffane, Tipu, & Ryan, 2011). These dimensions are relevant in the older adult-PCA relationship because we need to understand what qualities of an older adult will help

them be more or less trusting, what qualities of PCAs can promote trust, and how the type of task performed in this relationship influences what is needed for trust.

A model of trust that was created by Mayer et al. (1995) demonstrated how these factors interact to influence the development and maintenance of trust. A modified version is displayed in Figure 1. The modification made to this model simply broadened "propensity to trust" (which was originally the only trustor characteristic included) to be "characteristics of trustor" to allow the potential inclusion of factors such as personality and self-efficacy, which have been shown to influence perceptions of trust (Mayer et al., 1995). The original model was developed in an organizational context focusing on employer and employee relationships as well as coworker relationships (Mayer et al, 1995). Thus, this model is applicable to the older adult and PCA relationship, which is also employer-employee in nature. However, due to the fact that the job responsibilities of the PCAs are primarily personal care tasks, there are likely to be different elements needed for the older adult to perceive the PCA as trustworthy.

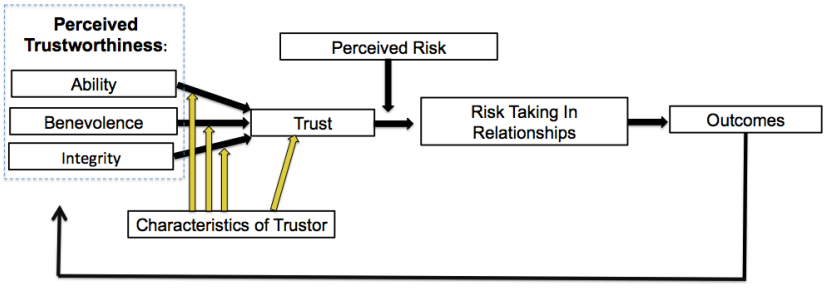

Figure 1. Model of Human-Human Trust adapted from Mayer et al. (1995). The dashed line around perceived trustworthiness highlights that ability, benevolence, and integrity are all subsets of how the trustee is perceived. The arrows show the various components interactions with each other.

An example of this model in the older adult and PCA relationship can be demonstrated in the task of transferring. Initially, if the older adult is a trusting person

and the PCA appears strong and knowledgeable, this will contribute to the development of trust. The amount of perceived risk (e.g., how badly could they be hurt if dropped, how likely they believe the PCA is to drop them) influences how much trust is needed for the older adult to actually take the risk of letting the PCA transfer them. If the older adult allows the PCA to pick him or her up, but is then dropped by the PCA half way through the transfer, this will in turn influence the older adult's perception of how trustworthy the PCA is to transfer them in the future. The main influences of trust identified in the literature are the qualities of the person trusting (i.e., the older adult), the qualities of the person being trusted (i.e., the PCA), and the context in which this trust is needed (e.g., type of relationship, type of task).

1.1.1 Qualities of Trustor

The trustor's personal qualities contribute to the formation and establishment of the trust by making them either more or less inclined to trust someone. The personal qualities of the trustor include the person's propensity to trust, their personality, and their self-efficacy.

A person's propensity to trust can be described as a person's belief about the trustworthiness of people and this in turn affects their desire to trust or not trust someone (Mayer et al., 1995). If an older adult believes in general that people are not trustworthy, then they are more likely to distrust a PCA. An older adult's general propensity to trust is also likely a moderator of what dimensions of trustee characteristics they need the PCA to encompass for them to trust them. For example, if an older adult is generally distrusting by nature, perhaps they will need far more qualities in a PCA to fully establish trust than an older adult who is trusting.

In addition to a person's belief about the trustworthiness of others, their own personality may affect their formation of trust. Traits such as agreeableness and extraversion have been shown to positively correlate with trust, whereas neuroticism has a negative relationship with trust (Evans & Revelle, 2008). For example, if an older adult loves to be surrounded by people, it is likely that they will be inclined to trust people in general and have little trouble trusting a new PCA in their home.

Finally, self-efficacy, a person's confidence in themselves, and its relation to trust needs to be further explored. Studies of self-efficacy and trust have primarily focused on online social networks and general self-efficacy (Wu, Wang, Liu, Hu, & Hwang, 2012). Even though older adults with PCAs may need assistance in several areas, their confidence in completing a task on their own may impact how willing they are to trust someone to assist them with that task. A person's overall readiness to trust others, their personality, and their self-efficacy can influence trust in a relationship.

1.1.2 Qualities of Trustee

The individual who trusts is also relying on evidence of the trustworthiness of the person or object they are trusting, the trustee. If an older adult is naturally trusting and outgoing, this may increase their initial formation of trust, but if the PCA never shows up on time and does not show the ability to perform any of the tasks, it is highly unlikely that trust will be maintained. A trustor's perception of the trustee's ability, reliability, integrity, benevolence, appearance, and communication will impact the development of trust (Mayer et al., 1995).

Though most of these terms are common in everyday language, we will define what each term means for the purpose of this study. Ability is a person's expertise or

capability to perform a given task or skill (Mayer et al., 1995). It could be the person's strength and knowledge of proper protocols to pick a person up and transfer them to a bath. Reliability is the consistency with which these skills and competencies are displayed, such as whether the person is able to routinely lift the person with little trouble (Gibson 1988). Integrity is defined as whether or not the person's values align with those of the one trusting. (Mayer et al., 1995). For example, if the older adult believes in a certain religion, it may help promote trust if they know that the caregiver has the same beliefs. An additional trait of the trustee is benevolence, which is the belief that the trustee wants to do good for the trustor with no basis in selfish intent (Mayer et al., 1995). The trustee's appearance ranges from their facial aesthetics to body build to ethnicity and can impact the initial development of trust or inclination to trust (Birkás, Dzhelyova, Lábadi, Bereczkei, & Perret, 2014).

Communication is a complex dimension of trust that could contribute to the establishment of trust within a specific task, however, understanding exactly how it could contribute to trust needs to be further explored. The frequency of communication, usefulness of communication, and openness of communication were identified as antecedents of trust in a literature review of supervisor-subordinate trust (Nienaber et al., 2015). Trust is also positively correlated with the perceived effectiveness of communication (Zeffane et al., 2011). This could be because the trust was established, so the communication was apparently more effective, or that the effective communication supported the development of trust.

To further complicate communication and trust, it has also been shown that all the previously mentioned facets of trust (e.g., expertise, appearance, reliability) can also

impact how trust is developed in communication (Giffin, 1967). For example, how reliable and benevolent the speaker is, and the extent of their ability on the subject material can affect whether they are believed to be trustworthy (Giffin, 1967). This could mean that in this context an older adult may trust the PCA more if they communicate with them, but this would only come about if within their communication the older adult also felt like the PCA was trustworthy in what they were saying. Communication was already found to be important for home health care so understanding how it influences trust could inform why it is important (Beer, McBride, Mitzner, & Rogers, 2014).

1.1.3 Type of Relationship

The final component of trust is the type of relationship in which the trust is being established. In addition to reviewing information that shows there are variations in trust depending on the type of relationship, the current trust literature in nurse-patient relationships will also be addressed.

Trust literature studies have focused on a variety of relationships, from romantic to work related. Trust has been studied most commonly using a general or global scale of interpersonal trust, which establishes a person's beliefs about a human's overall trustworthiness (Couch & Jones 1997). Romantic relationships have been studied frequently and have included dynamics such as secure attachments that are not seen in most other trust literature studies (Simpson 1990). Trust in the relationship of employer and employee is also a focal point of trust literature, in which there is a strong emphasis on the reactions and attitudes of employees to decisions of the employer and the perceived need for change by the employee (Nienabar et al., 2015; van den Heuvel, Schalk, & van Assen, 2015). As the type of relationship changes, so do the elements

needed to support trust. The underlying concept is the same, but based on the task or situation, certain elements become pertinent because trust is context dependent (Dinç & Gastman, 2013; Mayer et al., 1995). Such literature recognizes that trust varies based on task, but different relationships and even the tasks within those relationships may have aspects needed for trust that have greater impact than others.

There is a limited amount of trust literature that is directly relatable to the relationship between older adults and PCAs. Several studies have focused on older adults and trust in general. A large-scale study, by Poulin and Haases (2015), used a cross-sectional and cohort sequential longitudinal design to find that interpersonal trust increases with age. In addition, an increase in trust was associated with an improvement in well-being (Poulin & Haase, 2015). Another study, which focused on demographic influences on trust, found that age was the only significant predictor of an increase in trust of the healthcare system (Guerrero, De Leon, Carlos, Evans, & Jacobs, 2015). A study about trust and caregivers investigated how informal caregivers establish trust with their support network, but did not focus on what the person being cared for needs to trust the caregiver (Ray & Street, 2010). Trust development between children with disabilities and PCAs has been studied, but the study was limited because trust was only measured through the researcher's perceived attachment of caregiver and child (Wilson, Morse, & Penrod, 1998), not the actual perceptions of trust held by the caregiver or the child.

1.1.3.1 Nurse-Patient Relationship

Research on the relationships between nurses and patients is most relevant to older adult/PCAs because they both involve the trustor putting their personal well-being in someone else's hands. Though relevant, these studies may not be directly applicable

because nurse and patient relationships involve different tasks than PCAs and older adults. For example, even in home health care, a nurse's primary job responsibilities are catheter changes, medication management and administration, patient education, and wound care; whereas PCAs assist with activities of daily living (ADLs) and instrumental activities of daily living (IADLs) such as bathing or light housework (McBride, Beer, Mitzner, & Rogers, 2011). Studies have explored the complexities of the trust relationship between nurse and client. First, we will review a study that focused on the development of trust between home nurse and older adults, and then we will discuss the literature that focuses on the dimensions important for the establishment of trust in this context.

Trojan and Yonge (1993) focused on understanding the development of trust between home nurses and older adults. The constructs they discussed were not formally defined, but some examples were given. Respect was an important element for the initial establishment of trust, both the nurses respecting the older adults and vice versa. Older adults wanted to feel like they were still valued and not treated as though they were mentally disabled or inhibited. As the relationship progressed, communication became an important part of how nurses portrayed trust. For example, they would vocally express their trustworthiness and would also show their care and concern for the older adult through language. A relationship in which both the nurse and older adult felt like they were helping each other was considered the final phase of the development in establishing a trusting relationship (Trojan & Yonge, 1993). All of these elements are important to keep in mind while studying PCAs and older adults; however, since PCAs complete a broader variety of tasks, we need to understand how a task affects trust.

In the nursing literature, patients have expressed that the way or reasons the nurse performs the tasks influences their trust. One qualitative study found that patients' primary concern was the preservation of dignity and feeling cared for in vulnerable situations (Berg & Danielson, 2007). The preservation of dignity was divided into two main themes. First, the patient wanted to be involved and heard in the development of care with the nurse. Second, the patient wanted to feel like the relationship was one that was based in care and concern for the patient even without personal relationships with nurses being formed. Berg and Danielson (2007) also found that the feeling of vulnerability had its own sub-themes. These sub-themes comprised feeling cared for despite the workload of the nurses, fear of not being cared for or not having their needs met, and having a lack of certainty in the relationship of care. A patient's perception of their care can affect their trust in their nurses.

The importance of feeling cared for and respected as pertinent to the development of trust is also found in a review of the literature by Dinç & Gastmans (2013). Though these are personal qualities of the nurses, they are not directly related to how they perform the task, but instead address the reasons why or how a task is performed. Dimensions of empathy, such as an ability to understand the patient's needs that are not explicitly stated or to understand the difficulties or pain of the patient were identified as influential to trust (Dinç & Gastmans, 2013). Respect was again found to be an important factor. This included openness to the patient's personal life and choices as well as simply providing reassurance or comfort (Dinç & Gastmans, 2013).

The traits of the nurses are also an important part of the nurse-patient relationship. Gibson (1988) found that nurses and patients weighted the dimension of credibility

(ability) in trust as more important than the dimensions of reliability and integrity. Skill level and reliability were also important and hindered trust if they were not apparent (Dinç & Gastmans 2013; Gibson 1988). Though these dimensions are important for this relationship, the nurses' traits go beyond just their ability, benevolence, or integrity. These are demonstrated in more specific ways such as their dedication to caring for the patient (benevolence) or trustworthiness as a trait, but there is a greater emphasis on the feeling cared for and respected than is found in general human-human trust literature.

Trust in the older adult and PCA relationship can be related to some of the elements of the nurse and patient relationship. Both relationships include aspects of vulnerability and reliance on another for personal health and wellbeing. However, the relationship between an older adult and caregiver also has many differences than the nurse-patient relationship. One important difference is that these tasks are performed in the home of the older adult. Another important factor is that in nurse-patient relationships, the nurse involved with the patient changes regularly, whereas in the context of older adult and caregiver, the caregiver(s) is consistent. Caregivers also perform a wider variety of tasks such as cleaning, cooking, social companionship, and transportation. Despite these differences it was found that trust promoted satisfaction in the nurse and patient relationship, which then led to improved illness management (Dinç & Gastmans, 2013). Trust in the PCA and older adult relationship could have similar effects, which could be key to an improvement in care and health. Therefore, gaining insight into what is needed for trust to develop in this relationship could be very beneficial for aging adults.

Trust is important to maintain a good relationship (Rotter 1980). It has been studied by understanding personal influences of the person trusting and the person being trusted (Mayer et al., 1995), and through understanding the relationship in which the trust is formed (Couch & Jones, 1997). Each of these contributes to the development and maintenance of trust. Even though research on trust has encompassed several different kinds of relationships and personal characteristics (Couch & Jones, 1997; Dinç & Gastmans, 2013; Evans & Revelle, 2008; Gibson 1988; Giffin, 1967; Mayer et al., 1995; Nienaber, Romeike, Searle, & Schewe, 2015; Ray & Street, 2010; Rotter 1980; Wu, Wang, Liu, Hu, & Hwang, 2012), no research has been done that directly studies the older adult and PCA relationship. This gap in the literature should be addressed because knowledge of how an older adult comes to trust a PCA can be used to improve the relationship, which in turn could improve the older adult's quality of life.

1.2 Human-Automation Trust

Before delving into the human-robot trust research specifically, we will first do a brief over view of the extensive research done in the human automation trust as this is the foundation for the research in the HRI field. Human-automation trust has been shown that an operator trust in an automated system predicts their usage of that system (Parasuraman & Riley, 1997). For example, if the operator does not trust the system, they are less likely to use that automation. This shows that for the successful use of automation, trust is a key component.

Several elements have been identified as pertinent to human-automation trust. Overall reliability of automation is a predictor of trust, but impacts of the system failures are complex and it is not always predictable how they will impact operators trust

(Parasuraman & Riley, 1997). Operators may calibrate their trust reactively to the performance of the system, that is trust is dynamic and based on the system's reliability (Merrit, Huber, LaChapell-Unnerstall, & Lee, 2014).

In a review of automation-trust literature, Olson (2011), identified several aspects that previous literature has found to influence trust within this context. A few of these are: system feedback quality (Seong & Bisantz, 2008), reliability (Madhaven & Wiegmann, 2007), automation errors detection (Muir & Moray, 1996), operator self-confidence (Lee & Moray, 1994), and personality traits (Merrit &Ilgen, 2008).

These studies have been conducted with general automation. The research with human-automation related to assistive automation or technologies has focused on the development of trust models (M'Hamed, Zerkouk, Husseini, Messsabih & Hassan, 2013; Nam, 2009). There has been no research that has specifically investigated trust and assistive automation, but rather the proposed models have been based on prior general human-automation trust research. Human-automation trust has also laid the groundwork for beginning to understand human robot trust. However, it is only the beginning as again trust is context dependent and there are many variables such as an increased level of personal vulnerability in an assistive automation or technology that is likely to impact the elements that support trust within that context.

1.3 Human-Robot Trust

As robots are being developed for the home and everyday life, it has become increasingly important to understand human-robot interaction. An important component of human-robotic interaction is human-robot trust. Trust has been shown to influence the level of automation usage and acceptance, and how users designate tasks (Olson, Fisk, &

Rogers, 2011). The research on human-robot trust is a relatively recent field of study and there is a limited body of literature as compared to studies of human-human trust. The research that has been done has identified similar themes to human-human trust: the human's characteristics (qualities of the person trusting), robot's characteristics (qualities of the object (person) being trusted), and the environmental characteristics (type of relationship) (Sanders, Oleson, Billings, Chen, & Hancock, 2011). Training and design are two additional categories that have been identified as influencers of human-robot trust.

A model by Sanders et al. (2011), developed through an investigation of the current human robot trust literature and collaboration with subject matter experts (SMEs), shows how these various components interact to impact human robot trust. A simplified version of it is provided in Figure 2 (details of the human, environmental, and robot characteristics have been removed). This model shows how the human, environmental,

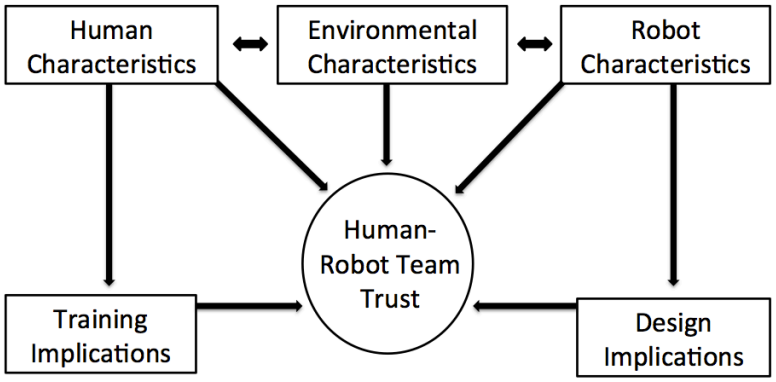

Figure 2. Trust model adapted from Sanders et al. (2011). The arrows show how the characteristics impact each other and the trust in Human-Robot Teams.

and robot characteristics all influence the human-robot trust directly, and how the human and robot characteristics can influence the type of training or design of the robot, which in turn influence the HRI trust as well.

1.3.1 Human Qualities

The first component identified as having an impact on trust in HRI is the qualities of the person trusting. Multiple qualities have been identified: personality traits, self-confidence, propensity to trust, general attitude towards robots, and knowledge of the robot (Hancock et al., 2011, Sanders et al, 2011). A few of these (personality traits, self-efficacy, and propensity to trust) were also identified as influencers of trust in the human-human trust literature. These have already been defined and explained in detail in this paper, thus those qualities that are specific for human-robot trust will be addressed here. The general attitude towards robots could be thought of as a robot specific propensity to trust. For example, if someone has never liked robots, then they will most likely not trust a robot. Their knowledge of the robot is for the specific robot with which they interact. However, this may be less of a human quality, but instead could primarily be impacting the trust because this gives the user a greater knowledge about the characteristics of the robot that influence trust.

1.3.2 Robot Qualities

The qualities of the robot also influence HRI trust. Some of these qualities are based on the robot's performance, such as its reliability and predictability (Ezer 2008; Hancock et al. 2012; Sanders 2011). Reliability was already defined in the human-human context, and predictability signifies that the robot acts in a way that meets with the older

adult's expectations. Reliability and predictability were terms that were associated with a trustworthy robot (Olson 2013).

A few studies have investigated the effect of faulty robots on trust (Kaniarasu, Steinfeld, Desai, &Yanco 2013; Salem, Lakatos, Amirabdollahian, &Dautenhahn 2015). These studies found that when robots are faulty it decreases the user's level of trust in the robot. The robot had to provide feedback in some manner for the user's to perceive its faultiness and adjust trust accordingly (Kaniarasu, Steinfeld, Desai, &Yanco 2013). This exhibits the influence of a robot's capabilities on trust.

Other qualities are aspects such as the robot's proximity to the human, the type of robot (Hancock et al. 2012; Sanders 2011) or the appearance of the robot (Ezer 2008). One study found that when robots were co-located with the user, the user was more likely to comply with the robot's instructions implying a greater level of trust (Bainbridge, Hart, Kim, & Scassellati 2008). Another study found that compared to a computer agent or a projection of the robot, participants reported higher trustworthiness for the co-located robot (Powers, Kiesler, Fussel, & Torrey, 2007). For older adults receiving care, the assistive robots will likely be co-located so this may increase the degree to which they are willing to comply with the robot and exhibit trust in the robot.

1.3.3 Environmental Qualities

Environmental characteristics encompass the type of task and communication (Sanders et al. 2011). The type of task has also been identified by human-human trust literature to influence trust (Dinç & Gastman, 2013; Mayer et al., 1995). In HRI literature, it has been suggested by SME in the field that task influences trust in robots, but this still needs to be explored. Communication has also been identified as an

antecedent of trust (Sanders et al., 2011). The studies that have assessed communication have found that participants trusted the robot more if it communicated in a style that was the same as the participant's culture (Rau, Li, & Li, 2009).

1.3.4 Training and Design

In the model proposed by Sanders et al. (2013), training and design are impacted by human and robot qualities, which in turn influence HRI trust (Billings et al. 2012; Sanders, Oleson, Billings, Chen, & Hancock, 2011). Although training and design are not the main focus of this study, the findings from this study could influence the training of older adults with home robotics and the design of home robotics.

1.3.5 HRI Trust in Older Adults and Home Care Robots

A few studies have begun to investigate what older adults need to trust robots in the home. One focused on general attitudes of older adults towards robots in the home, whereas another focused on how older adults conceptualized trusting a robot and what attributes they used to describe a trustworthy robot.

The first study by Ezer (2008) explored older adults' acceptance of robots in the home. Seventy percent of older adults stated that they would choose staying at home with an assistive robot instead of going to a care facility, and in general would trust a robot in their home (Ezer 2008). This shows that there is potential for robots as assistive tools for older adults to help them age in place. Ezer (2008) also examined older adults' perceptions of what would influence trust in a robot using the general scenario of robots providing care without any specific task. Fifty-five percent of older adults reported the robot's ability to perform the tasks as influential to trust (Ezer 2008). Other influences

reported were the robot's reliability, the user's experience with the robot, the robot's level of expertise, and ease of use (Ezer 2008).

A study by Olson (2013) specifically investigated qualities of HRI trust in domestic service robots important to older adults with low and high technology experience. This study found that 92% of older adults with high technology experience and 83% of older adults with low technology experience reported that they would trust a robot in their home. When asked to choose descriptions of a trustworthy robot, the top rated descriptions were: reliable, precise, efficient, and safe (Olson 2013). Overall findings from the descriptions showed that although technology experience provided some variance in responses, older adults were far more similar than different. Participants were also asked what they would want to know about a robot before trusting it. In all groups, the most frequent response identified the robots' capabilities and limitations, which shows the importance of the robots' functionality in trust.

These studies found general dimensions that impact trust and descriptors associated with trustworthy robots, but they do not explain how trust varies and the degree to which an older adult's level of functionality and self-efficacy may influence what is needed to trust robots for various tasks. It is important to understand the details of what is needed to establish trust for specific tasks and how an older adult's capabilities may influence HRI trust so that robots can be designed to maintain a level of trust that promotes successful use of the robot.

1.4 Overview of Study

Trust is variable and influenced by many factors. To understand what supports trust in a particular context, it must be studied within the specific task and relationship.

The human-human trust literature has focused on many different relationships (e.g., nurse-patient,), but past research has not specifically investigated trust in the older adult and PCA relationship. In the HRI literature, a few studies have explored some general concepts of human-robot trust in the home care context, but none have assessed how this trust varies by task. Moreover, past research has not examined whether human-robot trust differs from human-human trust in the personal care context. This proposed study will investigate trust in the older adult-PCA and older adult-robot relationships in the context of home care.

In prior research, independent-living older adults reported that a change in functionality (e.g., needing more assistance) would influence their trust in a robot, but it was not clear how (Ezer 2008). Therefore, in this study we focused older adults who lived in assisted or independent living that receive 4 or more days of care because they have greater needs for assistance. These individuals are also primary patient group for caregivers and assistive robotics. Their experience with caregivers would likely allow them to have insight into trust in a care context.

This study used a mixed methods approach to explore what factors influence trust between an older adult and PCA and an older adult and robot in a home care context. We also assessed whether trust is influenced by a person's self-efficacy as this has been identified in some contexts to influence trust, but needs to be further investigated. Questionnaires were used to explore self-efficacy in daily living tasks, descriptive information about participants (e.g., demographic, technology experience, robot experience, personality, experience with caregivers, level of assistance, propensity to trust), importance of dimensions of trust by task, preference of robot or human for

assistance, and care provider imagined. A semi-structured interview was used to examine the details of the factors that older adults who receive care from caregivers perceive as important to supporting trust within the context of an older adult being cared for by a care provider, both robot and human. To fully understand trust in both the older adult-human caregiver and older adult-robot relationship we provided scenarios in the interview of various care tasks (bathing, medication assistance, transferring, and household tasks) and explored what is needed to sustain trust for each specific task. By furthering our understanding of older adult-PCA and older adult-robot trust in the home care context, we can better grasp and promote beneficial older adult and care provider relationships.

1.4.1 Study Objectives

The main objective of this study was to understand which dimensions of trust are important in older adult-care provider relationships, both human-human and human-robot, because this knowledge can be used to improve the relationship. To gain insight into trust in this relationship, this study concentrated on these questions:

1. What factors influence older adults trust in human and robot care providers?
    a. Do the dimensions of trust identified in literature emerge in the older adult-care provider relationship?
    b. Do new dimensions of trust emerge in the older adult-care provider relationship?
2. Do the factors that influence older adults' trust in a care provider differ if the care provider is human versus robot?

To gain a deeper knowledge about trust in this context, we took a qualitative approach to help us understand the underlying reasons behind why a person decides to

trust a care provider for a certain task. Because very little is known about this context, as previously discussed, and there is no established standard measurement for trust (Cohn 2015), qualitative data collection is the most informative for our purposes.

CHAPTER 2. METHOD

2.1 Participants

The final inclusion criteria were that participants needed to be fluent in English, be above the age of 65, live in either an assisted or independent living facility, and receive 4 or more days of care from a care provider. Participants were not required to receive assistant with specific tasks, but just receive at least 4 or more days of care.

Participants were screened by a phone or short in person interview prior to scheduling participation to ensure they meet the qualifications. Upon conclusion of the study, participants were compensated thirty dollars for their participation.

All older adults were recruited from the Atlanta area. Recruitment was done through email, flyers, and local organizations (assisted and independent living facilities) that have contact with older adults in this population. In addition, they were recruited through the Human Factors and Aging Laboratory Participant Registry, a registry that contains the contacts of older adults who have expressed interest in being contacted to participate in research.

In total, 24 older adults, aged 65 + (M=81, SD= 7.13, age range 67-96) were interviewed (12 from assisted living facilities and 12 from independent living facilities). The participants were predominately female (22 females, 2 males). Overall, the participants were diverse in race/ethnicity and level of education. In general, participants reported that their health was fair. Around a third reported that they had difficulty with vision and hearing, but over half reported difficulty walking or climbing stairs. On average, the older adults in this study had mild cognitive impairment (5 participants were

not able to complete the MOCA due to visual or motor impairment). For more detailed results see Table 1.

Table 1. **Participants' Demographic and Health Descriptive Information**

Factor	Measure	Participants
Ethnicity	Black/African American White/Caucasian Other	29% (7) 67% (16) 4% (1)
Education	Less than high school graduate High school graduate/GED Some or in-progress college/Associates degree Bachelor's degree (BA, BS) Master's degree Doctoral degree	8% (2) 17% (4) 71% (10) 13% (3) 13% (3) 8% (2)
General Health[a]	"In general, would you say your health is…"	*M*= 2.38 *SD*=1.06
Health Standing in Way[b]	"How often do health problems stand in the way of you doing things you want to do?"	*M*=3.42 *SD*= 1.21
Average Number of Prescription Meds	"How many different prescription medications do you take each day?"	*M*=5.25 *SD*= 2.92
Self-reported Vision	"Do you have serious difficulty seeing, even when wearing glasses?"	Yes=21% (5) No=79%(19)
Self-reported Hearing	"Do you have serious difficulty hearing?"	Yes=38% (9) No= 62% (15)
Self-reported Mobility	"Do you have serious difficulty walking or climbing stairs"	Yes=58% (14) No=42%(10)
Montreal Cognitive Assessment[c] (n=19)		*M*=23.05 *SD*=4.01

a. 1=Poor, 2=Fair, 3=Good, 4=Very Good, 5=Excellent
b. 1=Never, 2=Seldom, 3=Sometimes, 4=Often, 5=Always
c. Score ≥26 = Normal

A requirement for the study was that participants received 4 or more days of care. For details about care see Table 2. On average, participants received around 6 days of care a week with the caregiver staying on average between one and three hours. Participants all reported receiving assistance with housekeeping, and more than half reported receiving assistance with medication assistance and bathing. However, only a couple participants reported receiving assistance with transferring. This shows that participants did in fact have experience with caregivers and most received assistance with almost 3 of the 4 scenarios, which allowed them to better imagine scenarios of the various tasks and types of care providers.

Table 2. Participants' Experience with Care Providers

Factor	Measure	Participants
Days Assistance Received Each Week (n=23)*		*M*=6.05 *SD*=1.53
Average Length of Caregiver Stay[a]		*M*=2.00 *SD*=1.05
Percentage that Receive Assistance with Tasks[b]	Bathing	58%
	Food Preparation	83%
	Housekeeping	100%
	Laundry	96%
	Medications	67%
	Transferring	13%

*One participant did not wish to answer.
a.1=Less than an hour, 2=1-3 hours, 3-4-6 hours, 4=6-12 hours, 5=12-24 hours
b. Reported care received ranged from some, a lot, to total assistance.

2.2 Materials

2.2.1 Demographic and Health Questionnaire

This questionnaire was administered to obtain demographic and health information as well as information on the participant's vision, hearing and motor capabilities. The questionnaire was designed for research done to develop technologies for older adults with disability, but it has been adapted to only contain the relevant information about capabilities in daily life activities. See Appendix A.

2.2.2 Technology Experience Profile

This is a 36-item questionnaire that was developed to gauge the use and familiarity of participants with various technologies (Barg-Walkow, Mitzner, & Rogers, 2014) The six categories of technology included are: communication, every day, recreational, computer, health, and transportation. For each of these six categories, there are several different technologies listed for which participants will rate their frequency of use in the last year on a 5-item scale (1=not sure what it is, 2=not used, 3=used once, 4=used occasionally, and 5=used frequently). This was administered to describe the older adults' level of experience with technology as this may influence their responses for what they need to trust robots (Olson 2013). See Appendix B.

2.2.3 Daily Living Self-Efficacy Scale

A ten-question self-efficacy scale of several different daily living tasks was used to evaluate the participant's self-efficacy to perform these tasks independently (Sanford, Griffiths, Richardson, Hargraves, Butterfield, & Hoenig, 2006). This scale is an adjusted version of the Falls Efficacy Scale to measure confidence in 10 routine household tasks.

We are using this task specific scale because self-efficacy is domain specific (Bandurra 2006). See Appendix C.

2.2.4 Assistance Level with ADLs and IADLs Questionnaire

This questionnaire was developed to learn about the participants' amount of assistance with a variety of ADLs and IADLs. The ADLs and IADLs were taken from the Katz Index of Independence in Activities of Daily Living (Shelkey & Wallace, 1999) and the Lawton-Brody Instrumental Activities of Daily Living (Graf 2009). We based the questionnaire on these two scales because these are standard measurements of an older adult's ADL and IADL skills. Two tasks, continence and money management, were not included because they are not relevant to our study. The questionnaire obtains information about how much assistance they receive for a given task, who assists them if needed, and how frequently they receive assistance. This questionnaire was used to describe the participant's capabilities and understand the type of assistance they receive. See Appendix D.

2.2.5 Formal Caregiver Experience Questionnaire

This questionnaire was developed to describe the experience each of the individuals have had with PCAs. This questionnaire obtained information about if they have ever hired a PCA, the resources they used to hire them, the number of days per week they received assistance, the amount of time the PCA spent on each visit, and the overall length of time they employed a PCA. See Appendix E.

2.2.6 Ten Item Personality Inventory (TIPI)

The TIPI was administered to assess personality (Gosling, Rentfrow, & Swann 2003). TIPI is an adjusted inventory based on the Big Five Personality test that assesses openness, conscientiousness, extraversion, agreeableness, and neuroticism. This assessment of personality was used to describe our sample. Participants rated themselves on 10 items by stating how strongly they agreed or disagreed that they saw themselves as two specific descriptors. See Appendix F.

2.2.7 Propensity to Trust Scale

A 21-question propensity to trust scale was used to evaluate the participants' inclination to trust others. The scale used is the same from the study of Evans and Revelle (2008). The scale will be evaluated on a 1 to 6 Likert scale based on level of agreement with each statement. Propensity to trust was measured to help explain the sample and account for personal differences in responses to the questions. See Appendix G.

2.2.8 Montreal Cognitive Assessment (MoCA)

The MoCA was administered to describe the participants' cognitive abilities and measure cognitive impairment. The MoCA includes a short-term memory recall tasks, visuospatial abilities, executive functioning assessment, attention, concentration, working memory, and language assessments (Nasreddine et al., 2005).

2.2.9 Dimensions of Trust by Task Questionnaire

This questionnaire was developed to help capture the relative importance of previously identified dimensions of trust to each task. We decided to make this questionnaire because asking the questions during the pilot testing of the interview did

not elicit the desired information and encouraged the participant to focus only on the list of dimensions that confounded the data. This questionnaire has a section for each of the six tasks and under each of the tasks there is a Likert Scale of 1 to 7 for rating how important this dimension is to trust the caregiver for the specific task. We ordered all the variables in the order that they were asked in the interview. See Appendix H.

2.2.10 Ten Item Personality Inventory for Care Providers

In materials testing, a theme that emerged was the discussion of the PCA's personality influencing the older adults' development of trust; because of this we decided to also include a personality trait inventory in which the older adults would report what personality traits they would want a PCA to have. It has been shown in literature that when informant's fill out a personality inventory for someone they are close to, that this correlates highly with the self-report of that person (Vazire 2006). This shows that people are able to accurately assess someone else's personality to a certain degree and so an older adult should be able to accurately complete a personality assessment for the ideal character traits that they would want their PCA to have to be able to trust them. To be consistent between robots and PCA, we also included a scale for them to rate what kind of personality they would want the robot to have. We created an adjusted version of TIPI using wording from the informant report used for the personality inventory in the DSM (Markon, Quilty, Bagby, & Krueger, 2013). See Appendix I.

2.2.11 PCA Visualized Questionnaire

This questionnaire was developed based on the findings that in previous studies for the robot scenarios many participants visualized a robot. We also want to understand if participants also visualized a PCA while discussing the scenarios and if this changed

based on task. We gathered information about gender, ethnicity, and height. This helps describe the type of caregiver visualized by the participant and gain further insight into older adults' expectations of PCA. See Appendix J.

2.2.12 Robot Visualized Questionnaire

This questionnaire was developed using the findings from the studies by Ezer (2008) and Olson (2013) that explored home robotics and gained insight into how participants imagined or visualized robots. This questionnaire was used to assess whether the participant imagined a robot when going through the robot care provider scenarios. If they did imagine a robot, this questionnaire targeted understanding what kind of robot they pictured, such as assessing whether the robot was human-, machine-, animal-, or TV/movie-like. Information about the physical attributes of the robot such as its height and other features such as presence of head, face, arms, interface, were also ascertained. The questionnaire inquired about how they imagined the robot was controlled. Finally, this questionnaire asked if the robot visualized changed for any of the tasks discussed. This was administered to gain insight into what older adults expect robots to be like in the home. See Appendix K.

2.2.13 Trust in Assistance Questionnaire

This questionnaire was developed to understand trust preference for various tasks (Olson 2013). It was modified to contain only the same ADLs and IADLs as in the level of assistance questionnaire. This questionnaire ascertained whether the older adult would only trust a human, trust a human more, trust either a human or a robot, trust a robot more, or only trust a robot for each task. This is beneficial to understand because even if the older adult has insight into what they would need to trust a robot or human for a

specific task, it does not mean they would necessarily choose to trust a robot more or human more for that task. See Appendix L

2.2.14 Robot Familiarity and Usage Questionnaire

This questionnaire assessed the participant's familiarity with and usage of various robots (Smarr et al. 2014). The participants rated 13 different categories of robots using a Likert scale to indicate if they are: not sure what it is (0), never heard about, seen or used this robot (1), have only heard about or seen this robot (2), have used or operated this robot only occasionally (3), or have used or operated this robot frequently (4). See Appendix M.

2.2.15 Robot Self-Efficacy Scale

A short questionnaire was administered to gain insight into the older adult's self-efficacy of being able to use a robot to complete a task. They rated their level of confidence from 1-Not at all confident to 7-Completely confident on using a robot to complete a task: if no was around to tell them what to do, if they only had the manuals for reference, and if someone showed them how to use it first.

2.2.16 Semi-Structured Interview

To help ensure uniformity throughout the interviews, a structured script was developed. The script was developed initially by a review of the trust literature. Three SME semi-structured interviews were conducted to help with the development of the interview script and materials. We interviewed several different types of experts to understand the development of trust from different points of view. We interviewed someone who receives assistance from PCAs, a president of a home care company, and

someone who has expertise in establishing trust with older adults in vulnerable situations. For a summary of their qualifications see Table 3. After the SME revisions, we then proceeded with several rounds of materials testing to ensure that our materials were eliciting the right information to answer our research questions.

Table 3. A description of the expertise of each SME.

Subject Matter Expert	Description of expertise
Care recipient of PCA	• Wheelchair user • Researcher that focuses on persons with disabilities • Receives care from PCAs for a variety of tasks
President of Home Care Company	• Certified senior advisor • Experience with training PCAs how to create a positive relationship with older adults • Hires PCAs for company • Matches PCAs with older adults
Care provider	• Develops trust with older adults in a variety of vulnerable situations • Works with other EMTs each shift and knows their methods of developing trust

The beginning of the script informed the participant of the different sections of the interview. This included older adults being informed that they will do an ability test, take part in a structured interview that will focus on what they would need to trust a care provider with various tasks, and complete several questionnaires. The participant was told of the general timeline and the goals of the interview, thus emphasizing the importance of expressing honest opinions.

Half of the participants began with the robot portion of the interview and then proceeded to the PCA portion, and the other half began with the PCA portion of the interview and then proceeded to the robot portion. For the purpose of describing the

script we focus on the PCA portion first and then the robot portion as both scripts are essentially identical.

After turning on the recorder, the interviewer began with an icebreaker to help the participant feel comfortable. Following the icebreaker, the interviewer then described the interview and overarching scenarios the participant should imagine for the PCA section of the interview. Trust was defined so that the participants understand what is meant by trust for the purpose of the study. Then the term formal caregiver was defined to ensure the participant fully understands what is meant by the term throughout the interview as recommended by SME. All participants were asked to imagine the scenario that that they need a new PCA and could only perform the tasks with help from PCA. The participant was also given a card with the definition of trust to refer to throughout the interview.

The scenarios chosen for the interview script were both identified by literature and through the SME interviews. The several tasks were identified to be some of the most frequent task performed by formal caregivers in the home of older adults (Mitzner, Chen, Kemp, & Rogers, 2014). The task of bathing was added upon recommendation from SME.

The first scenario that was discussed is bathing, which was chosen out of all the tasks because it requires the most personal vulnerability. For the bathing scenario, we asked specific questions about dimensions of trust identified in the literature. Four of the elements are discussed in both human-human and human-robot literature (ability, reliability, appearance, communication), two are specifically from human-human literature (integrity, benevolence) and two are specifically from human-robot literature (precision, predictability). The aspects included that are specific to either human-human

or human-robot dimensions of trust are in the top identified influences of trust in those specific contexts that do not fit into any of the overlapping categories. After bathing, medication assistance, transferring, and household tasks will be discussed (see Table 4 for the descriptive scenarios). For each of these, first they were asked about general needs for trust. For all tasks, they were also asked about what attributes would cause them to not trust the caregiver.

Table 4. Scenario descriptions for each task.

Imagine you have a new formal caregiver who is going to assist you with:	
Bathing	This will include them helping you remove your clothes and physically helping you bathe.
Medication Assistance	This means they would help remind you to take medications at the appropriate time and perhaps bring the medication bottle to you.
Transferring	This will include the caregiver helping you sit up, lifting you, and moving you to the wheelchair.
Household Tasks	These tasks will include helping plan and prepare meals and doing some light housework such as laundry, doing the dishes or making the bed.

For the final portion of this section, we asked the participant to focus on what we have discussed and consider what attributes they would want a PCA to have in general. This portion of the interview is where we discussed the concept of benevolence and its relation to the development of trust. We first defined benevolence based on the literature and then inquire as to its overall importance as well as if the participant believed the importance would vary across the tasks previously discussed. We also inquired about characteristics that the participant would find desirable and undesirable in a PCA as a way to close up this interview section.

Following the portion discussing PCAs, we then moved on to discussing robots. The scenarios and questions were the exact same as the PCA section, but with robot in place of PCA. For example, instead of asking an older adult to imagine that they needed a formal caregiver after an operation to assist with various tasks, we asked them to imagine that they needed a robot to assist with various tasks. For the robot scenario, we also asked all of the in-depth questions for bathing that we did for the PCA section. After going through the remaining tasks, we concluded with a general section asking the older adult what they would want a robot to be like overall for home care assistance and what role the concept of benevolence plays in trusting a robot to perform certain tasks. The interview will then be concluded with an overall invitation to any other thoughts or questions they may have. See Appendix N.

2.3 Procedure

Older adults from the Atlanta area were located through either the Human Factors and Aging Laboratory database or by recruiting through assisted and independent living facilities in the Atlanta area. These older adults were contacted by telephone or by flyer. During the telephone call or on-site visit, they were asked if they wanted to participate in a study concerning trust and care providers with household and daily living activities. If they express a desire to be a part of the study, then details were provided about the study such as length and compensation. Older adults were prescreened to make sure that they are eligible for the study and met the requirements.

When participants met the eligibility requirements, a session was scheduled and a packet containing a letter with the time, date, and location of the interview, directions (if applicable), parking pass (if applicable), two consent forms (one to be reviewed and

signed by participant, the other for the participant to keep), and pre-interview questionnaires (demographic and health questionnaire, technology experience profile, daily living self-efficacy scale, assistance level with ADLs and IADLs questionnaire, formal caregiver experience questionnaire, ten item personality inventory, and propensity to trust scale) are mailed or given to them. Participants were also given the option to complete these questionnaires in person prior to the interview or at the same time.

Once at the scheduled interview, the interviewer either reviewed the consent form for the participant's signature and checked pre-interview questionnaires to ensure completion or they administered the informed consent and questionnaires at the time of the interview. If the consent form was not signed or the questionnaires were not completed, the interviewer would have them completed after reviewing the materials. The interviewer then reminded the participant of key points of the consent form and made sure they still want to continue with the study. The interviewer also reminded the participant that the interview would be recorded and later transcribed.

The interviewer then read an introductory paragraph about the study and its sections. The participant was not informed that robots would be discussed to prevent premature focus on robots and the comparison of humans and robots. The discussion of robots and PCA was counterbalanced to help account for carry over effects. Following this, the interviewer administered the MoCA. After this was completed, the interviewer proceeded to the interview portion of the study.

To begin the interview portion, the interviewer started with a general question about what the participant’s favorite hobby was to help the participant feel comfortable. Then the interviewer read the overall scenario for the interview and how trust was

defined for this study. Then they gave the participant a card with the definition of trust and ask the participant if they have any questions. After questions, the interviewer turned on the recorder and begin the interview. The interviewer first asked about what the older adult would want an ideal formal caregiver (or robot depending on the group) to be like to trust them in these various tasks. In-depth questions were asked about the first task of bathing. All the other tasks were discussed generally by asking the participant what they would want to be able to trust the caregiver or robot for that task. To conclude the first portion of the interview, the interviewer discussed general qualities that the older adult would considers important to the development of trust. Then participants completed the PCA visualized questionnaire. Upon completion, the participants will be asked if they want to take a 5-minute break.

If the participant began with the PCA portion, then the robot portion of interview would begin and vice versa. The interview again first asked about what the older adult would want an ideal robot (or caregiver) to be like to trust them in these various tasks. For the first task of bathing, in-depth questions about the various dimensions important to trust were asked. The other tasks were discussed generally following the discussion on bathing by asking them what they would want to be able to trust the caregiver for that task. To conclude the robot portion of the interview, the interviewer discussed general qualities that an older adult would consider important to the development of trust. The participants then completed the Robot Visualized questionnaire. The participants were again asked if they would like a 5-minute break.

Next, the participant completed several different questionnaires. They complete the questionnaires in the following order: TIPI for care providers, dimensions of trust by

task questionnaire, trust in assistance questionnaire, robot usage and familiarity questionnaire and robot self-efficacy questionnaire. After all the questionnaires and test are completed, the participants were given a debriefing sheet and compensation.

CHAPTER 3. RESULTS

3.1 Overview of Analysis

3.1.1 Quantitative

The questionnaires and response frequencies from the qualitative coding were analyzed using Excel to calculate frequencies and descriptive statistics. Excel also was used to conduct chi-square tests to check for thematic differences between responses related to the human and robot caregivers.

3.1.2 Qualitative

3.1.2.1 Data Segmentation

Audio files were transcribed verbatim and then uploaded into MAXQDA Version 12. Interviews were segmented into units of analysis before the data were qualitatively coded. The interview was segmented in two separate ways. For the beginning parts of the interview that focused on a specific caregiver and task, a segment was defined as an entire response that related to one type of caregiver and one specific task. For the general questions, a segment was defined as an entire response to a question. All interviews were segmented by one individual to ensure all the interviews were segmented the same.

3.1.2.2 Coding Scheme Development

The coding scheme was developed with a combined top down and bottom up approach (Hsieh, & Shannon, 2005; Pope, Ziebland, & Mays, 2000) to encompass all factors that participants may perceive to be important to trust in this older adult-care provider context. That is, it reflects the over-arching themes of previous literature, as well as any new themes that emerged in the data. This coding scheme was used to categorize

participants' answers to each discussion topic, which will allow us to analyze what attitudes participants shared. The coding scheme has categories and definitions for each category that were developed between two coders (See Appendix O).

To identify bottom up themes, three interviews were randomly selected from the interviews in assisted living and one was selected from independent living (more were included from the assisted living group because when developing the initial coding scheme only assisted living interviews had been completed; we then included a transcript from independent living to ensure no new themes were emerging that had not already been capture). Two coders reviewed these interviews and discussed what themes appeared to emerge from the interviews that did not fall into the previously identified dimensions or were a new sub-theme to one of the current dimensions. Once a theme was labeled and defined, it was added to the coding scheme.

3.1.2.3 Intercoder Reliability

To ensure coding was consistent between individual coders, several rounds of intercoder agreement were conducted. To ensure reliability of the coding of the qualitative interview, a Cohen's Kappa was calculated for each round to make sure that the coders were in agreement with each other using MAXQDA Version 12. Although there is no set standard for agreement between coders, 80-90% is the normal range for a minimum level of agreement (Saldana, 2012); thus we set an interrater reliability of 85% as the minimal threshold of agreement.

For the first round of intercoder agreement, an interview was randomly selected from one of the assisted living interviews to be coded independently by each coder. The first round of intercoder reliability was 84.71%. The coders reviewed the codes where

they disagreed and made clarifications to the coding scheme or added codes where necessary to meet agreement. Codes added included, sub-categories for communication dividing it into both content and manner of communication and adding additional subcategories to reliability. Clarifications were made between knowledge for the task and general capability. A second round of independent coding was performed on the same transcript. The second intercoder reliability was 92.66%, above the goal of 85%.

A second round of coding was performed on another randomly selected interview from the three interviews selected from assisted living. Coders independently coded the same interview. Interrater reliability was 85.89%. While this met the 85% intercoder requirement, the coders still met to discuss any discrepancies in the coding scheme and added a category for inappropriate touching or behavior, as well as, a category for attitude towards doing the task.

Finally, a third round of coding was conducted on the randomly selected transcript from independent living. Again, coders independently coded the transcript. For the third round, interrater reliability was 91.61%. Upon reaching three rounds of intercoder reliability, the remaining transcribed interviews were then divided up (author coded 17 and other coder coded 4) between the coders to be coded independently.

The results begin with discussing the general characteristics of the participants, as well as a brief summary of the type of care providers participants imagined. Following that discussion, the qualitative results from the interviews are discussed and in conclusion, desired personality in care providers and the importance of dimensions of trust questionnaire results are discussed.

3.2 Characteristics of Participants

Table 5 presents descriptive characteristics of the participants. Overall, participants reported being moderately agreeable and somewhat extraverted, both traits are correlated with trust. Participants reported themselves as being moderately trustworthy and trusting, which are positively associated with trust.

Participants reported moderate confidence in completing daily living tasks. However, there was variability between individuals with some being very high on self-efficacy and others very low (range:16 to 100). The participants overall had a neutral level of self-confidence in operating robots.

The participants had limited technology use and experience with robots. When asked if they would prefer to trust a robot or a human, on average participants reported that they would prefer to trust a human.

3.3 Care Provider Visualized

Participants were asked whether they imagined a care provider when discussing the scenarios. For the human care provider, the participants only reported imagining a female caregiver (70%), with the rest either not imaging a gender or not imagining a specific caregiver at all.

The traits of the robot imagined varied across participants. The participants primarily referred to the robot as a “him”, and 29% reported imagining it was male. 25% reported imagining a machine-like robot and 21% reported imaging a TV or movie-like robot. Half of the participants imagined the robot was made of metal and that it had a head and arms. In addition, most participants imagined that the robot moved around and was controlled either via programming or by the user.

Table 5. Participant Characteristics

Factor	Measure	Participants
Technology Usage[a]	"In the past year, how often have you used…"	*M*= 0.79 *SD*=0.57
Robot Usage and Experience[b]	"Please indicate your familiarity in terms of hearing about them, using or operating them"	*M*= 1.25 *SD*=0.59
Personality[c]	Agreeableness	*M*=6.16 *SD*=0.91
	Conscientiousness	*M*=6.04 *SD*= 0.91
	Emotional Stability	*M*=4.54 *SD*=1.55
	Extroversion	*M*=4.88 *SD*=1.50
	Openness	*M*=4.92 *SD*=1.31
Propensity to Trust[d]	Trustworthy	*M*=5.37 *SD*=0.59
	Trusting	*M*=4.52 *SD*=0.87
Self-Efficacy for Daily Tasks[e]	"How confident are you in performing…?"	*M*=61.27 *SD*=29.13
Robot Self-Efficacy[f]	"I could use a robot to perform a task if…"	*M*=3.61 *SD*=1.67
Trust Preference	"If I needed assistance, I would be more likely to…"	*M*=2.18 *SD*=0.66

a. 0-not used; 1-used once, 2-used occasionally, 3-used frequently
b. 0-Not sure what this is, 1-Never heard about, seen, or used this robot, 2-Have only heard about or seen this robot, 3-Have used or operated this robot only occasionally, 4-Have used or operated this robot frequently
c.1-Not at all confident, 10-Completely confident
d.1-Strongly inaccurate, 6-Strongly accurate
e.1-Not at all confident, 7-Completely confident
f. 1-Only a human, 2-Prefer a human, 3-No preference, 4-Prefer a robot, 5-Only a robot

3.4 Summary of Qualitative Analysis Results

During the interview, participants discussed what a care provider would need to be like in order for the older adult to be able to trust the care provider for various task scenarios. The scenarios provided various contexts for the participant to imagine the relationship with the care provider, but no hypotheses were made about the influence of the individual tasks. Thus, the qualitative data were combined across the tasks. However, any emergent task differences are noted for each category in the summaries below.

For both the human and the robot care provider, the most common theme mentioned was professional skills (see Figure 3). The other themes mentioned were personal traits of the care provider, communication, and other. For human care providers,

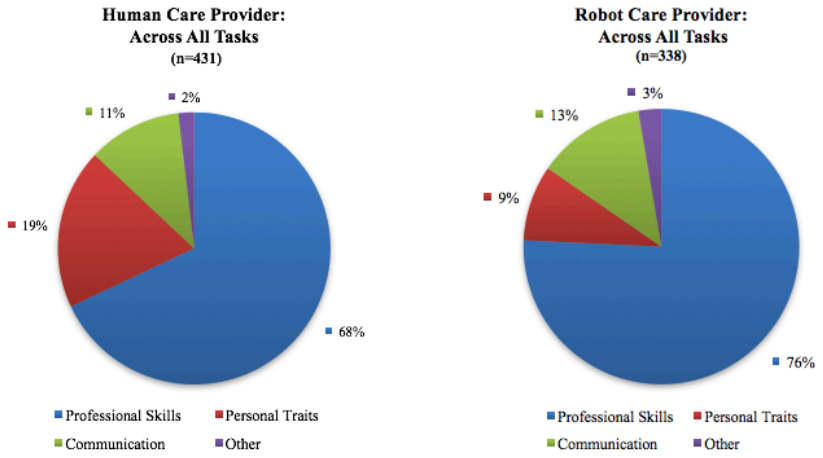

Figure 3. Human and Robot Care Provider Themes

there were 93 more thematic frequencies mentioned than for robot care providers. This is most likely due to the fact that participants have experience with human care providers, but none with robot care providers and in turn have more to discuss. Next, we review the details of the comments related first to human care providers and then to robot care providers. We focus on the sub-categories that comprised at least 5% of the overall

comments for each main category (e.g., 5% of all the comments related to professional skills and the human care provider). A 5% cut off has been used by prior research to distinguish commonly mentioned themes from minor themes (Mitzner, Stuck, Hartley, Beer, & Rogers, 2017). Therefore, we chose this percentage to eliminate focusing on sub-categories that are not prominent themes or were only mentioned by one person.

3.5 Human Care Provider

The interview data were consistent with themes that have been observed in human-human care provider relationship. In addition, our analysis revealed emergent themes relating specifically to human and robot care providers.

3.5.1 Professional Skills

Professional skills were the most frequently mentioned category for the human care provider. Within professional skills, there were four main categories (ability, knowledge, reliability, and other). Figure 4 provides detailed information about the frequencies of themes within the professional skills category. Table 7 on page 56 provides the number of participants that mentioned each category that reach a threshold of at least 5% of the total number of comments related to professional skills.

Previously identified themes that were mentioned frequently were: precision, general capability, procedural knowledge, consistency of performance, and predictability. Precision and predictability have been identified as contributing factors to human-robot trust, but participants also identified these as relevant to the human-human care provider relationship.

We can understand more about how the participants were thinking about trust along these dimensions through example quotes from the participants. For precision,

participants mentioned "*If they did something in a very haphazard, sloppy way that would not sit well with me. If I notice them being careful, particular and thorough, that would score point*." An example of general capability is "*Well that they do it correctly. I've been in…ambulances and they've got that down to an art. Exactly how to do it. Turn your body this way, turn your body that way…so you have to know exactly how to do it.*" Procedural knowledge was similar to general capability, but it was specific to the information that older adults wanted the care provider to have. For example, one participant said "*knowing how to handle a sick person and is slow about moving around and handling me well.*

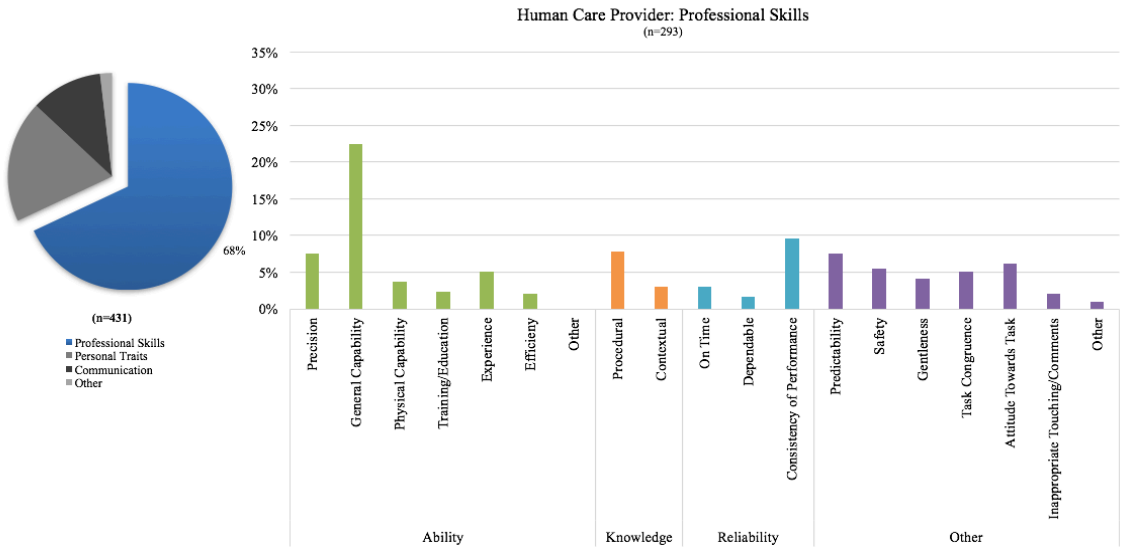

Figure 4. Professional Skills of Human Care Provider

Emergent themes for this older adult and human caregiver context were safety, task congruence, and attitude towards doing the task. Safety had been identified in the human-robot literature, but not the specifically in the human-human literature. Examples of comments related to safety include: "*There again my number one would be safety. Is she careful about, you know, that I can step in and out of the shower, without falling, that*

the water isn't too hot or too cold, that she has checked that out first, and that kind of thing. Safety is still my number one concern." Task congruence was defined as whether the care provider performed the task in the manner that the participant preferred. An example comment is: "*working with me in the task instead of insisting on moving your will in the task.*" The other frequently mentioned theme that emerged was the caregiver attitude towards doing the task. This can be distinguished from benevolence as benevolence is the attitude towards the older adult, while this theme encompassed the caregiver's attitude towards actually doing the task. For example, participants mentioned "*Whether they were being mechanical or whether they were being thoughtful about what they were doing,"* and *"That they indicate that they don't mind doing it the tasks."*

3.5.2 Personal Traits

Participants also reported that personal traits of the caregiver would help them trust the caregiver more (See Figure 5; Table 7 on page 56 provides the number of participants that mentioned each category that reach a threshold of at least 5% of the total number of comments related to personal traits). Congruence of care provider values and benevolence were identified in previous literature and were mentioned frequently by participants. When referring to the congruence of care provider values, participants mentioned comments such as, "*if they were raised in a farm house somewhere…that's not the way I was raised, so my values would be different. The things that I expect and the things that I want out of life and in my life in a dwelling pretty much reflect the way I was raised. And I would expect that would be true the caregiver too*," or "*I would say yes they are important in that a person's values always show up in their activities and the way they perform their work and their daily lives*". When discussing benevolence participants

stated, "*Somebody…who…cares about people in general, not just as a job, but that they care about people*."

Benevolence emerged independently as a theme within the data, however, at the end of the scenarios when inquired what role benevolence would play within this context. 23 of the 24 participants stated that benevolence would impact trust. For example, one participant stated, "*I want to make sure that they are doing it for the purpose of helping me. Not that they are going to get any gain, not asking for a tip or presents, or money something like that."* Of those, only 6 reported that they thought the role benevolence played would be impacted by trust. An example of how participants thought it might vary within tasks was "*Well, you know if you are doing something like taking wash out of the washing machine or taking the trash out, it's not going to matter one way or the other. But other things that involve safety and personal care do matter."*

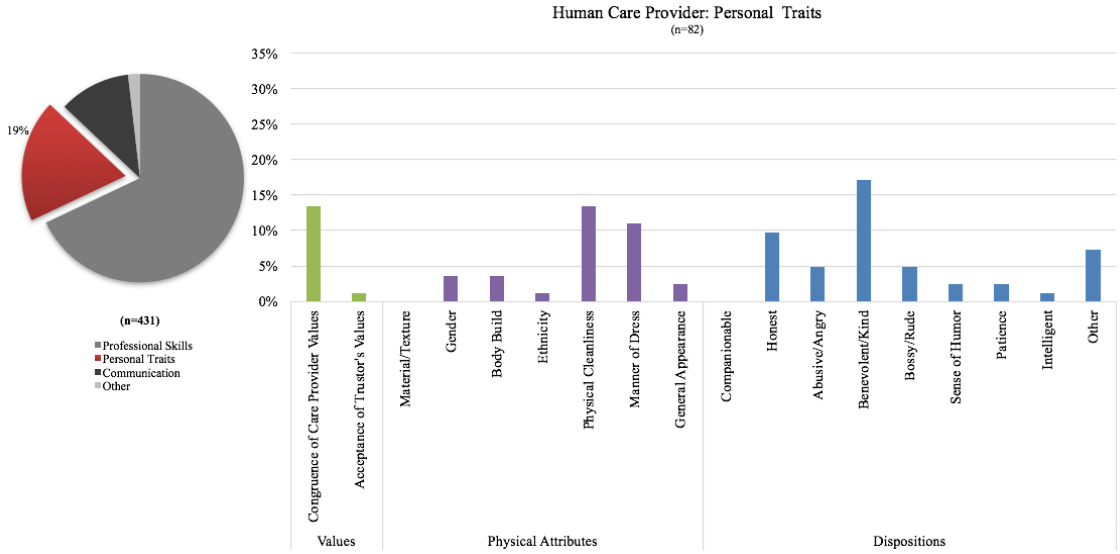

Figure 5. *Personal Traits of Human Care Provider*

While physical appearance was mentioned in prior literature, it referred to facial features and level of attractiveness. For this study, physical cleanliness and manner of

dress were the themes that emerged recurrently. For physical cleanliness, participants mentioned "*If they don't look like they've showered themselves in a week, I don't want them giving me a shower.*" An example of manner of dress is "*That they are a neat person. Dressed accordingly to the task."*

Another emergent theme was honesty. Honesty was defined for this study as a care provider that is straightforward in conduct. Participants commented "*if I find them in my closest or if I find them somewhere in my apartment that they are not supposed to be*" and "*if I had pills and one of my pills is a pain pill, okay. I wouldn't want to catch one of my pills gone, 'cause that would automatically stop... I would cut it right there. And matter of fact, I would call it in*."

The other category had several responses, but none of these fit with in a particular theme. Some of the dispositions mentioned wanting a care giver that was not intrusive. Another mentioned wanting a care provider that had confidence. However, these were comments made by individuals and not common across all participants.

3.5.3 Communication

Communication has been identified as being related to trust, but prior research has not studied what type of communication supports trust. In the interviews, two general themes emerged, content of the communication and manner of the communication. See Figure 6 (note: the percentages for the communication graphs are presented at 65% instead of 35% because of the fewer number of categories and frequencies). Table 7 on page 56 provides the number of participants that mentioned each category that reach a threshold of at least 5% of the total number of comments related to communication.

Some participants mentioned wanting task specific communication. For example, "*that they explain what they are giving me uh as best they can and as…thorough as they can and ask me if I understand*" and "*Telling me what they are preparing me for. Issuing specifics about what they are going to need to do with me and for me*". Others mentioned desiring personal communication, such as "*If we could just talk to one another and tell each other how we feel about things. I think that would help us an awful lot. If I could get a bit personal with her, I think that would help me a lot."* Personal communication was only mentioned with the physical contact tasks, bathing and transferring. When

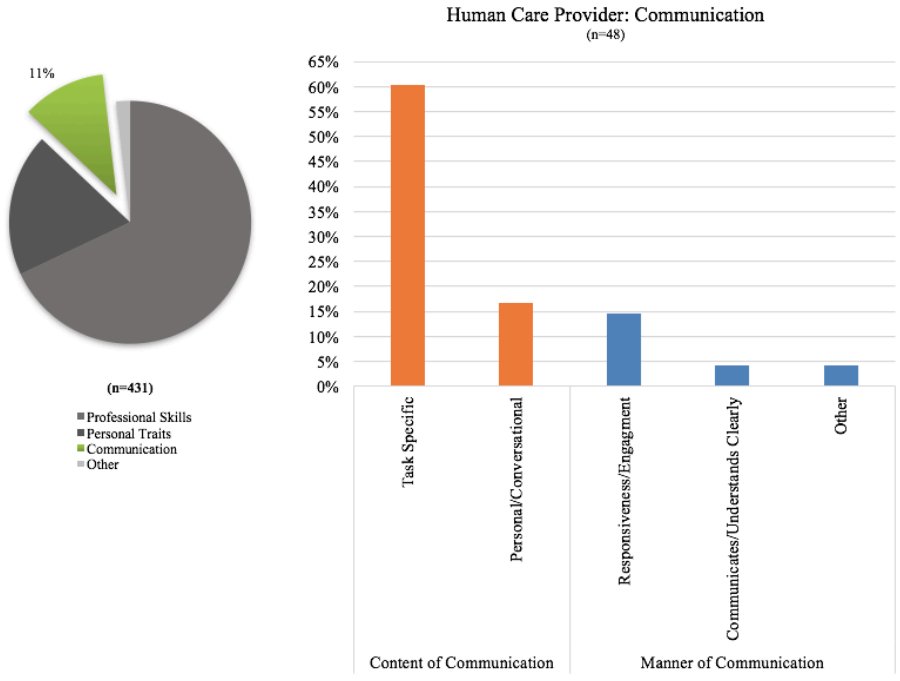

Figure 6. Communication of Human Care Provider.

discussing the manner of the communication participants mentioned wanting caregivers to be responsive and engaging. For example, participants stated "*I like for them to check on me from time to time, poke their head into the door and say, 'You okay?'"* and *"when I ask to do something, say, "Would you bring me the telephone I need to call my mother,"*

or "I need to call my daughter would you bring me the phone please," then I would like for them to do that."

3.5.4 Other

Only 2% of all the human care provider comments fell in the category of other. There were two themes that did not fit within the previous categories. Experience with a person has been previously identified as impacting trust. In this context, participants discussed that experience would be necessary for them to trust a caregiver. For example, "*I'd need to know them really well. I would need for them to know me really well*."

Another theme that emerged was the use of cellphones. Several participants mentioned, when asked what would cause them to not trust a caregiver, "*I think it would be the phone issue again which I have had a problem with some aids being on the phone too much*."

For older adults to trust a caregiver, they reported wanting the caregiver to have professional skills (e.g., ability to perform the task, reliability), but they also want a caregiver that cares about them and has similar values. In addition, personal qualities such as the way the caregiver dresses to their level of honesty were reported impact the older adults' trust in a caregiver. The older adults also reported desiring both personal and task specific communication and a caregiver that actively engages in these means of communication.

3.5.5 Differences Between Tasks

While in general, patterns remained relatively similar across tasks, there are a few differences worth noting. For both the task of bathing and house hold tasks, personal

traits were mentioned almost twice as much than they were for medication assistance and transferring.

For professional skills, general capability was mentioned more frequently for medication and household tasks than bathing and transferring. Procedural knowledge was mentioned more frequently for medication and transferring. Task congruence and the caregiver attitude towards doing the task were mentioned most frequently with household tasks.

There was some task variance in the personal traits. Physical attributes were mainly mentioned in reference to bathing. Benevolence emerged in all tasks except for medication assistance.

For communication, the participants only mentioned the desire for personal conversation in relation to the two tasks that require human-human touch, bathing and transferring.

3.6 Robot Care Provider

Similar to the human care provider, professional skills, personal traits, and communication emerged as important within the older adult-robot care provider context. Within each of these categories both previously identified themes, from both human-human and human-robot trust literature, emerged as important to supporting trust, but there were new emergent themes as well.

3.6.1 Professional Skills

In the robot care provider context, the previously identified dimensions: precision, general capability, consistency of performance, and predictability were frequently mentioned within this context (see Figure 7). Precision was most frequently mentioned

with bathing and household tasks. For example, one participant mentioned "*That (precision) is important to me…because I would want to feel that it is done right and I wouldn't be able to trust the robot if it's not done right.*" When referring to general capability, some participants stated "*That it got the right bottles. Just if they're gonna just bring me the bottles, as long as they bring the right bottles, that's all I would require,"* and "*To lift properly, and to place me in the proper position so that I won't hurt myself.*" An example of consistency of performance mentioned is ""*Well, some days a human would do it thoroughly and other days they wouldn't, so the robot would need to do it the same way every time*." For predictability, one participant commented "*Yeah that (predictability) is really important. Much more important than that because you don't interact with a robot in the same way you do with a person, I don't think."*

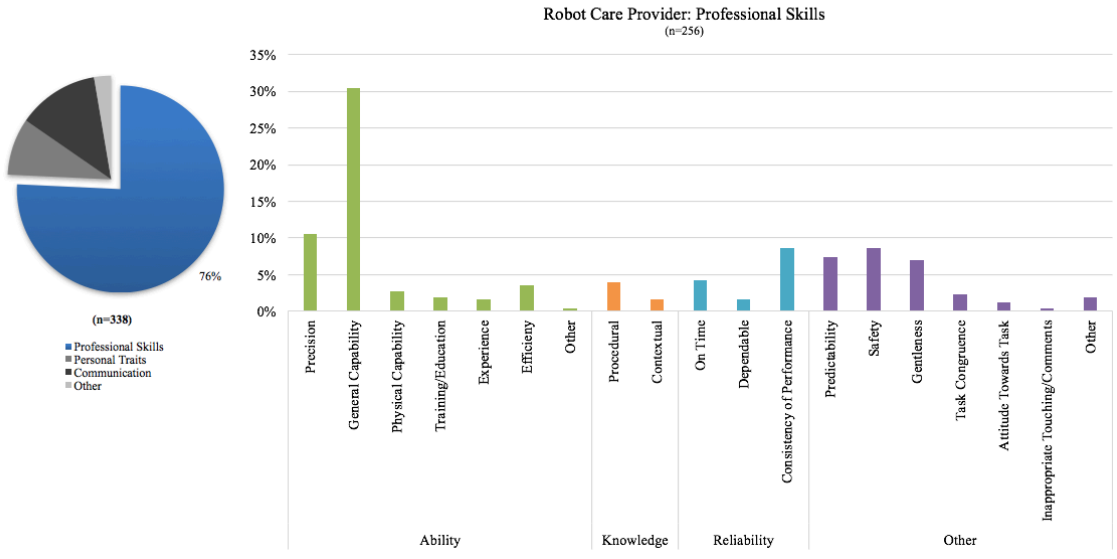

Figure 7. Professional Skills of the Robot Provider

Emerging themes within the professional skills were safety and gentleness. Both of these were primarily mentioned within the tasks of bathing and transfer. For safety,

participants mentioned comments such as "*To know for sure that it won't electrocute me. I mean there's water and there's mechanical and you know*," and "*if he dropped me or even if he hurt me while he was doing it. Now...I don't(know) if I would trust a robot.*" An example of gentleness mentioned was "*That they be gentle, and, because I have a lot of pain*."

3.6.2 Personal Traits

For the robot care provider, previously identified themes such as the congruence of care provider values, and benevolence also emerged. See Figure 8. An example of congruence of care provider values mentioned was "*well, I feel like that for me to trust him, he has to have good values like I do."* Participants that mentioned benevolence stated "*Well, I feel like that for me to trust him, he has to…really show me that he wants to help me, and do his job, and I will trust him".*

Benevolence was also specifically inquired about at the end of the robot care provider scenarios. 16 participants stated that they thought benevolence played a role in trusting the robot care provider. For example, "*Oh, that would play a lot of role. I would really trust him. If he's doing exactly what I want him to do*." When asked if it would vary based on trust, 7 said it would. An example comment is "*Yes, it would matter on the task. Whether it was something small, like bringing the coffee, but other things like being in the shower and keeping me safe, that is a whole different issue*." There were 6 participants that reported benevolence did not play a role because they did not believe the robot was capable of being benevolent. One participant stated *"I don't think the robot would know about benevolence. I don't think it would matter".*

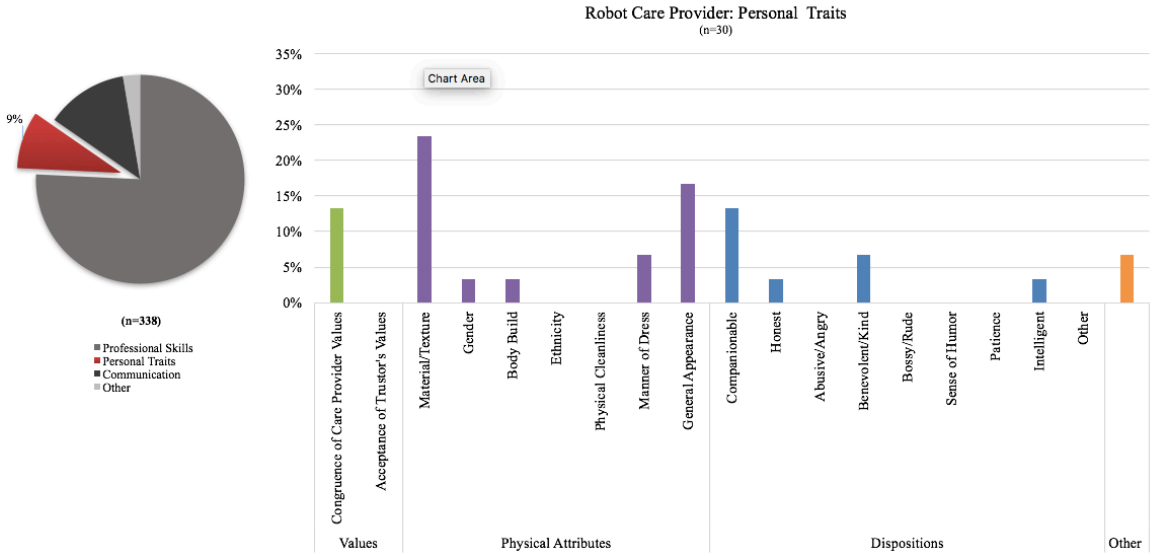

Figure 8. Personal Traits of Robot Care Provider

While appearance has been identified as a dimension that influences trust, participants in this study focused on the material or mechanical aspect of the robot care provider as impacting trust. For example, one participant mentioned, "*Have warm hands. Definitely. I can only picture this metal concoction in my mind. I just can't conceive me going through that."* In addition to material, participants also mentioned manner of dress, such as "*if it's for me only, being dressed as a female in some variety … even if it is some pant suit."* In the other category for physical attributes older adults' comments ranged from wanting the robot care provider to be animal like or human like, to wanting the robot care provider to have a pleasant color.

A theme that emerged from the interviews is the desire for the robot care provider to be companionable in order to support trust. For example, one participant stated, "*That it would be friendly and be, I don't know how much personality they have... whatever is programed into him I guess. But … I would want him to get along with baby dog if it*

will." Another participant stated, "*Well, I would want that robot to like me, too. ..I would want him to know that I trust him, so we would get along fine together."*

3.6.3 Communication

Communication overall has been identified as an impactor of trust within the human-robot context, however, how it impacts trust has not been identified. Themes of communication that emerged within the human-robot care provider context were the content and manner of communication. See Figure 9 (note: the percentages for the communication graphs are presented at 65% instead of 35% because of the fewer number of categories and frequencies).

For content, participants most frequently mentioned task specific communication. For example, one participant stated "*Assuring me…that it could do the task that I have asked it to do, that it has done it before, give me a list of the places it has been used and how it turned out."*

For manner of communication, participants commented on wanting a robot care provider that was responsive. Example quote stated is "*Answering questions and feedback as to how I feel"* and "*if they did not follow instructions."* Participants also stated that the robot care provider needed to understand them, "*First of all, it would understand me and basic directions"* and "*it would have to demonstrate that it understands its orders real well. Understands the orders and can recite them back to me or to someone who is with me."*

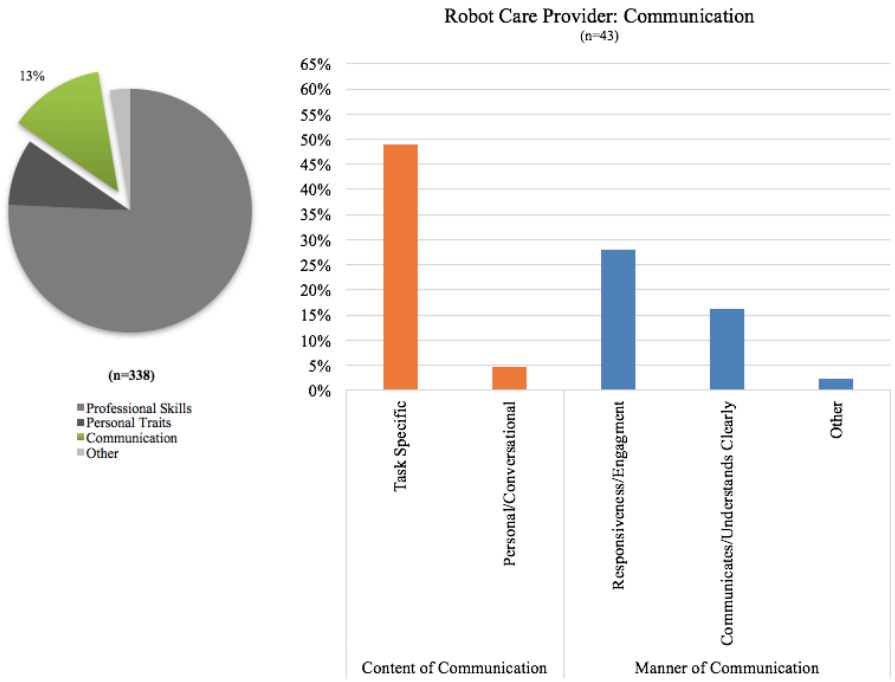

Figure 9. Communication of Robot Care Provider

3.6.4 Other

Only 3% of all comments fell into the other category. The most frequent comments were associated with experience with the robot care provider. For example, one participant stated "*to watch him on how he works. If he was around for a week, I would have to watch him and see how he works. If he did, everything fine, good and I would trust him."*

The older adults in this study primarily focused on the professional skills and capability of the robot care provider to perform the task. However, the physical texture of the robot, the values of the robot, the benevolence, and whether or not the robot is companionable also were perceived by the older adults to influence trust. The older adults focused on task specific communication and reported that the robot care provider

engaging in communication as well as comprehending communication would impact their trust in the robot.

Table 7. Dimensions by Total Number of Participants

Category*	Human Care Provider	Robot Care Provider
Professional Skills	**Participant Number**	**Participant Number**
Ability		
Precision	17	22
General Capability	24	24
Experience	9	-
Knowledge		
Procedural	15	-
Reliability		
Consistency of Performance	21	19
Other		
Predictability	22	18
Safety	10	15
Gentleness	-	11
Task Congruence	10	-
Attitude Towards Task	11	-
Personal Traits		
Values		
Congruence of Care Provider Values	11	4
Physical Attributes		
Material/Texture	-	5
Physical Cleanliness	11	-
Manner of Dress	7	-
General Appearance	-	5
Dispositions		
Companionable	-	3
Honest	7	-
Abusive/Angry	2	-
Benevolent/Kind	10	2
Bossy/Rude	3	-
Communication		
Content of Communication		
Task Specific	17	14
Personal/Conversational	6	<5% of comments
Manner of Communication		
Responsiveness/Engagement	6	11
Communicates/Understands Clearly	<5% of comments	6

***Only lists those that reached the 5% threshold out of the number of comments for each category for either the human or the robot care provider. A dash represents that the trait did not reach the 5% threshold for that care provider type.**

3.6.5 Differences Between Tasks

For the comments related to the robot care provider, there were some differences between the four tasks. For the overall categories, personal traits were mentioned most frequently for bathing and transferring. Comments related to communication were fairly consistent across bathing, medication assistance, and household tasks, but dropped by more than half for transferring.

For professional skills, precision was mostly mentioned for bathing and household tasks. Physical capability was mentioned primarily for transferring. Almost all of the comments related to wanting the robot to be on time were related to medication assistance. Predictability, safety, and gentleness were all mostly discussed when talking about bathing or transferring.

When discussing the personal traits of the robot, there were some differences in frequency of responses across tasks. Material and texture of the robot were only discussed for bathing and transferring. The trait of companionable was mentioned for all tasks except medication assistance. Benevolence was only mentioned in relation to bathing.

3.7 Human versus Robot Provider

The differences between human and robot trust is still not clearly understood, so this was analysis exploratory. To compare themes that emerged for the human and the robot care providers, we first performed a chi-square between the overall frequencies for each group. For the overall frequencies, there was a significant difference between the human and the robot (X^2=15.96; p<0.05). The standardized residuals show that the source of this difference is the personal traits. For the robot care provider, the personal traits

were less than the expected frequency (z=-2.67). For the human care provider, the personal traits were more than the expected frequency (z=2.36). This shows that for human care providers the personal traits emerged more frequently than for the robot.

As an exploratory analysis, we looked at the observed frequencies for each group, and compared the human and robot care provider frequencies for the categories within ability. For ability, there was no significant difference between the human and robot (X^2=9.1; p>0.05).

3.8 Desired Personality in Care Providers

On average, older adults desired similar personalities in both the human and robot care provider. They reported strongly agreeing that they would want the care provider to be agreeable, conscientious and emotionally stable. For extraversion and openness, they tended to only agree a little that those were desired traits to trust a care provider. For the detailed results, see Table 6.

Table 6. Average Desired Personality in Care Providers

Trait	Human	Robot
Agreeableness	*M*=6.92	*M*=6.48
	SD=0.24	*SD*=1.02
Conscientiousness	*M*=6.85	*M*=6.73
	SD=0.31	*SD*=0.66
Emotional Stability	*M*=6.94	*M*=6.63
	SD=0.17	*SD*=0.88
Extroversion	*M*=5.38	*M*=4.95
	SD=1.24	*SD*=1.59
Openness	*M*=5.56	*M*=4.98
	SD=1.12	*SD*=1.72

3.9 Importance of Dimensions of Trust

While the interviews gather in-depth information about the overall themes that emerge in this context and whether previous themes identified emerged, a questionnaire was administered to obtain what level of importance these variables were for each task. The importance for the traits was consistent across all tasks for both the robot and human caregiver. There is a trend that shows that appearance and values are less important for the robot than the human. See Figure 9 on following page.

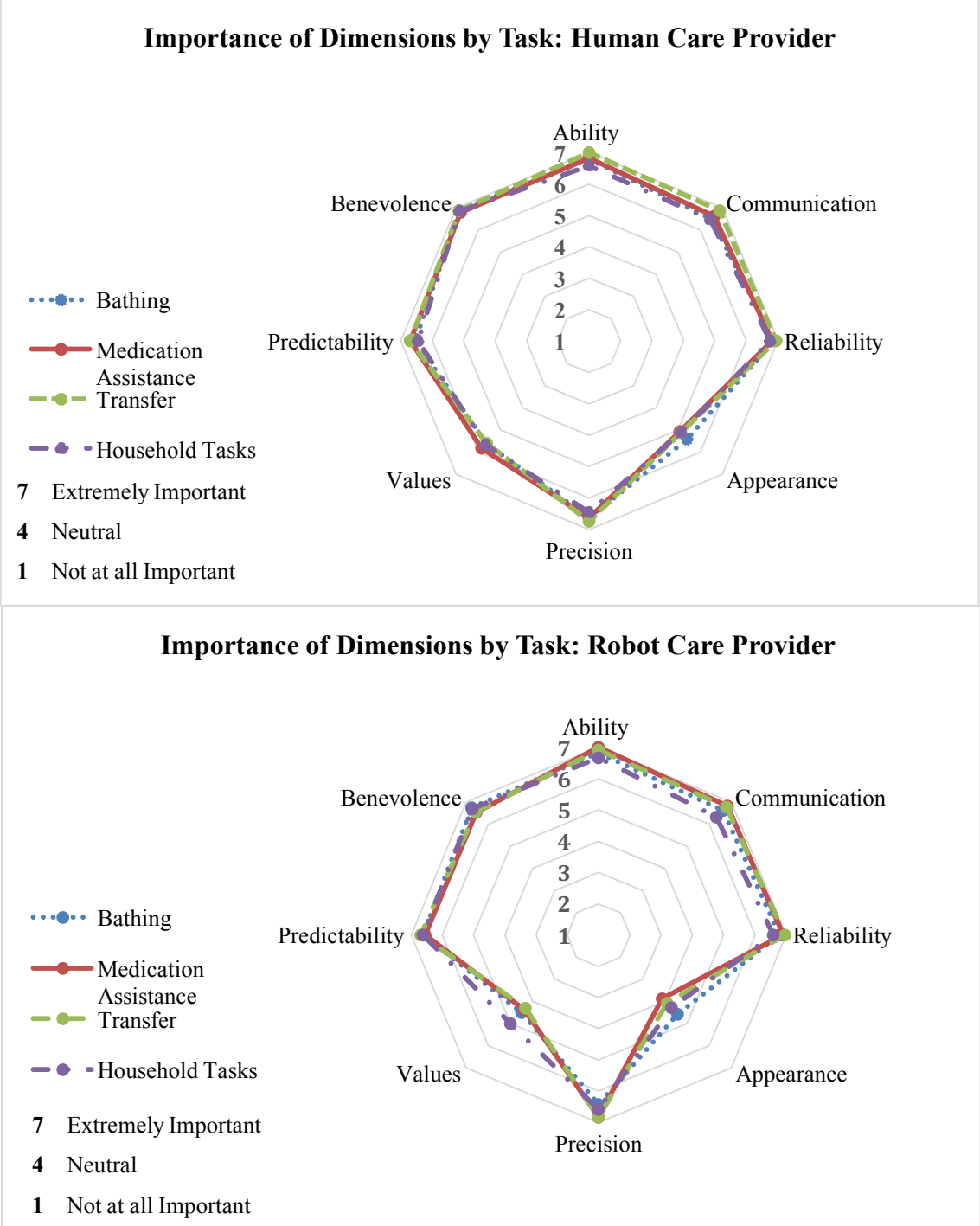

Figure 10. Importance of Dimensions by Task

CHAPTER 4. DISCUSSION

As the number of older adults in the United States continues to increase, it is critical to understand what is needed to create successful relationships between older adults and their care providers (Ortman et al., 2014). In the future, it is possible that care providers could be human or robotic; therefore, factors influencing trust in both of these contexts needs to be understood. In general, previous research suggests that trust is variable and that the key components that contribute to human-human trust are the characteristics of the trustor (e.g., personality), characteristics of the trustee (e.g., ability) (Mayer et al., 1995), and the context of the relationship (e.g., nurse-client) (Couch & Jones, 1997). In human-robot literature, the characteristics of the trustor (e.g., attitude towards robots), characteristics of the robot (e.g., reliability), and the environment (e.g., type of task) all contribute to trust (Sanders et al, 2011).

Trust literature has not addressed what factors support older adults' trust in a care provider or if there are differences in these factors between the human-human and human-robot relationship. Therefore, this study addressed these gaps by assessing the factors that influence trust between older adults and care providers and comparing these factors between the older adult-caregiver and older adult-robot context. A summary of the key findings from the study and the implications of these findings are presented in the following sections.

4.1 Human-Human Trust

Within the older adult-human care provider context, participants most frequently commented on the professional skills of the caregiver as a factor contributing to trust in

the relationship. Although these comprised over half of the themes that emerged, there were also frequent mentions of personal traits and communication. Within each of these, there were previously identified themes that emerged, as well as, new themes specific to this context.

Previously identified themes that emerged frequently within the professional skills category were general capability to perform the task (Mayer et al. 1995), precision (Olson 2013) , procedural knowledge (Gibson 1988), consistency of performance (Mayer et al. 1995), and predictability (Olson 2013). Both precision and predictability were previously identified in the human-robot literature, but participants' comments in the present research suggest that they are also influential in the human-human context. This may be, in part, because these traits were probed for in the task of bathing, but older adults still responded that they considered them important. In the personal traits, appearance was confirmed as being important for trust, but instead of physical attributes, participants primarily focused on the cleanliness of the individual and the way they dressed. Additional personal traits that were affirmed as being pertinent to this context were congruence of care provider values and benevolence.

Although prior literature has linked communication to trust (Giffin 1967) and non-trust related found communication was important in the home care context (Beer et al., 2014), further exploration of communication was needed to help understand what aspects of communication support trust. Two main themes emerged: content and manner of communication. Participants frequently commented on task specific communication, but also stated that they perceived personal conversation as supporting trust as well. The

manner of communication that participants commonly mentioned impacted trust was the responsiveness or engagement of the communication.

In addition to prior dimensions, there were also new themes that emerged in the older adult-PCA relationship. Within the category of professional skills safety (previously only identified in human-human literature), task congruence and attitude towards doing the task emerged. In personal traits, honesty of the caregiver emerged as a new theme of importance for supporting trust.

These traits had some variability between task. For some of the tasks such as bathing and household tasks, the more frequent comments about personal traits might be because these require the human care provider to be very personal with the older adult either physically or with their personal belongings. Medication assistance had less emphasis on personal traits such as benevolence, but a greater focus on general capability and procedural knowledge. This may be in part due to medication assistance not requiring personal touch or personalization, but still has a greater element for risk if not done correctly so there is an emphasis on the task being performed correctly.

Despite these few differences, overall patterns were consistent. These results have both theoretical and practical implications, which are discussed in the following sections.

4.1.1 Theoretical Implications

These findings demonstrate that although the model of trust from Mayer et al. (1995) represents many factors that influence trust in the employer-employee contexts, it did not comprehensively represent the main impactors of trust in the personal care context. This is most likely due to the personal nature of these tasks. Older adults' frequent mentions of personal traits impacting trust demonstrate that with personal care

tasks, to support trust, there is an increased focus on various personal traits of the caregiver, including themes from the model such as benevolence and values.

Apart from personal traits being more varied, there were also more themes related to task performance that emerged as important, such as safety. Although risk is shown to play a role in the model, it did not show the expected relation to trustee in the present study. For example, if the PCA is skilled and safely performs the tasks, the level of perceived risk may decrease. Although this relationship may not be true in all settings, the perception of risk in this context may be influenced by the capability of the caregiver.

In addition to previous factors, the concept of task congruence (does the care provider do the task the way the older adult prefers) emerged in this context. This is most likely because for most of the older adults, the tasks being performed are ones that at some point they, did for themselves. Therefore, they have preferences for how the task should be performed and although they are no longer capable of doing the task independently, they still desire for it to be done the way they used to perform the task.

In this context, another emergent factor that impacted older adults' trust in their care provider was the care provider's attitude towards performing the task. In addition to the care provider having the ability to perform the task and a general desire to do good, they will also be more likely to be trusted by the care recipient if they demonstrate a willingness to do the task.

These emergent themes demonstrate that the employer-employee relationship varies for the home-care context and highlights important themes that may be applicable to similar tasks that are performed in the home.

Apart from the emerging themes within this study, unlike most previous research, this study explored multiple tasks within the same relationship. The results from this study suggest that although previous literature has highlighted the impact of task on trust, it may be more context dependent than task dependent. This is not to suggest that task has no impact as there were some differences found between tasks, but simply that the role of tasks may not be as influential as previously thought. These findings are novel and require further exploration.

4.1.2 Practical Implications

This study allowed insight into the older adults' desired traits in PCAs. This information can be used to help improve training for PCAs, as well as help inform older adults about selecting a personal caregiver.

Companies seeking to improve trust between their PCAs and care recipients might benefit from highlighting in training the main impactors of trust identified in this older adult-human care provider context. For example, training should highlight that general capability, consistency of performance, procedural knowledge, precision, predictability, and safety are key to establishing trust in this context. In addition, PCAs should be trained that adapting task performance to the older adult's preference and their attitude towards the task can impact trust.

Based on the responses related to communication, additional training should be provided to help improve the communication skills of the caregivers. For example, because task specific communication was so frequently mentioned, it might be beneficial to provide caregivers with a standard script for describing tasks or steps of tasks to the older adult.

4.2 Human-Robot Trust

For older adults who are receiving care for the first time, they may not be aware of the many traits that are important in selecting a PCA. Older adults can be provided information about the overall traits that emerged as important, as well as highlighting the need for a care provider that has personal traits and values that are acceptable to the older adult.

In the human-robot context, participants most frequently commented on professional skills. Communication and personal traits were also mentioned as influencing trust. Within each of these, previous themes from both human and robot literature emerged. There were also some unique themes for this context.

Previous themes from literature relevant to the professional skills category that were also emergent in the interviews were precision, general capability, performance, safety, and predictability. In personal traits, themes that were identified in the human-human literature also emerged as important in this context were congruence of care-provider values and benevolence. However, this is the first study that identified these dimensions as being related to trust in the human-robot context. In prior research, appearance has also been shown to impact trust. For this study, older adults focused on the material or texture of the robot more than on its general look or appearance.

When older adults discussed what communication could support trust, two themes emerged, content and manner of communication. Within these, participants mentioned wanting a robot that had task specific communication, as well as, a robot that was responsive (e.g., responds to questions and obeys orders) and understood them.

An emergent theme within the professional skills category was gentleness. Within the personal traits, participants frequently commented on wanting a robot to be companionable.

There was some variability of the frequency of these traits between tasks. Professional skills such as predictability, safety and gentleness and personal traits (e.g., material and texture) were primarily mentioned for bathing and transferring. This is likely in part because these are the two tasks that require human-robot touch and so the older adults have a greater concern for comfort and protection. Benevolence of the robot was only mentioned in relation to bathing, which is likely because this is such a personal care tasks that perceived concern for the older adult supports their willingness to trust a robot. Companionable was mentioned for all tasks except medication assistance. Similar to the human-care provider, it may be because this is a less personal task.

4.2.1 Theoretical Implications

The results from this study confirm previous findings that ability to perform the task is one of the main contributors to trust in the human-robot context. However, the data also suggest that within care tasks there are other important factors that support trust. In fact, several of the dimensions identified in human-human contexts emerged as important in human-robot contexts. For example, many of the older adults perceived the need for the robot to be benevolent and have similar values as them. This demonstrates that despite the robot not being human, these care tasks require the human trait of "caring."

In addition to these, the emergent theme of wanting the robot to be companionable emphasizes the desire for a "personal" relationship with the robot despite

it being a machine. This, in addition to the desire for caring robots, demonstrates that within the care context, human-like qualities are important to take into consideration and the previous human-robot trust model by Sanders et al. (2011) do not fully encompass all the contributing factors.

4.2.3 Design Implications

Understanding the factors that support trust in the care context are pivotal to successful design and adoption of robots. Based on these findings, while ability of the robot is clearly a common theme, there are other factors such material, safety, benevolence, and communication that could impact trust.

It is critical to design a robot that not only performs the task well, but can be gentle with the older adult. This was seen in the emergence of the safety theme. The older adults need to be sure that the robot can perform the task safely and feedback should be provided if there is any error with the system so that the older adult can adapt their trust and use of the system accordingly.

The material and texture of the robot was discussed as impacting trust. This highlights that when designing a robot that will be physically interacting with a human, the texture and even temperature of the robot should be comfortable for the human.

When designing robots for home care, older adults expressed wanting a robot that is companionable. Robots in the home, even for care tasks, should be able to not only successfully interact with the physical environment, but also the social environment, including family and pets. In addition, to support trust in the older adult-robot relationship, the robot should be programmed to show the older adult that it is performing the tasks with the older adults' well-being as the primary motive. The older adults'

perceptions of the robot's values are also important. Creating flexibility in the system might be necessary in order to match a robot's "values" to the older adult's values.

Another design consideration is the communication between the robot and the human. Older adults expressed a desire for there to be task related communication. However, they also expressed the need for not only the robot to understand them clearly, but also that they could understand the robot. As older adults age, they are likely to have a decline in their hearing capabilities. When designing a robot for the care context, these findings suggest that creating a successful means of communication between the older adult and robot is needed to help support trust.

4.3 Human versus Robot Care Provider Trust

For the human care provider, participants reported 93 more comments than the robot. There were also significant differences overall for the dimensions that impacted trust between the human and the robot. In the human-human context, personal traits were more commonly mentioned overall than in the human-robot context. This suggests that although participants attribute some characteristics to robots such as benevolence and values, the personal traits of the care provider impact trust to a greater degree when the care provider is a human.

These differences may be reflective of the fact that the older adults in this population had experience with human care providers, but little to no experience with robots in general. It is possible that the fewer comments in general for the robot and the fewer comments about personal traits are due to the older adults having a limited mental model of a robot. The older adults in this study all had experience with human care providers and had an established mental model of their abilities. For the robot however,

since they had limited experience with robots, the older adults are not aware of the capabilities of the robot which would influence their frequency of responses that focus on specific qualities. The perceptions of desired traits to be able to trust robot care providers might change for older adults that have had experience interacting with a robot and future generations that may have a better understanding of the capabilities and limitations of the robot.

4.4 Limitations and Future Directions

Although this study provided insights into trust between older adults and care providers, it is necessary to identify this study's limitations and the future directions of research in this area. This study was designed to specifically understand the trust development with care providers and older adults. However, there are other human relationships of homecare that should be explored, such as informal caregivers or formal caregivers that are friends or family members.

Qualitative interviews were conducted to learn in-depth knowledge about the construct of trust in this relationship. While qualitative interviews were the best step to gain initial insight into this specific relationship, experimental studies with larger samples should be conducted to manipulate these factors and test their validity. Though 24 participants is a sufficient number for qualitative analysis, a larger sample size would be recommended to conduct a regression analysis of the contributing variables to help understand which elements contribute the most. Potentially with this further research, a matching system could be developed for older adults and PCAs in order to assist older adults in finding care providers that can fulfill their physical and social expectations. In addition, further research could create more specific guidelines for older adult home care

robots by manipulating factors mentioned in this study to experimentally test their significance.

4.5 Conclusion

While previous literature has explored and researched trust, it was still not understood specifically within the older adult-care provider context. This study found that professional skills, personal traits, and communication were all common themes that emerged in this context. This study validated that many previously existing themes do emerge as important for older adults to trust human or robot care providers, however, there were also emergent themes that were not encompassed by the models. In addition, this study found that there are differences in personal traits needed for older adults to trust either a human or robot care provider. These findings emphasize the volatility of trust and the need to understand it within specific contexts.

This study lays the groundwork for future research in trust in older adult and PCAs by helping us understand the dimensions that are important for the establishment of trust. Understanding trust in the older adult and care provider context will help us improve the lives of older adults by promoting successful interactions with both human and robot caregivers.

APPENDIX A: DEMOGRAPHIC HEALTH QUESTIONNAIRE

BACKGROUND QUESTIONNAIRE

For HFA Personnel Use Only DATE: __ __ / __ __ / __ __

SUBJECT ID: __ __ __ - __ __ __ __ -- __ __ __ __ __ -- __ __

Data Entered By:	DATE
1st _____	__ __ / __ __ / __ __
2nd _____	__ __ / __ __ / __ __

☐ Consent given to include data in archived repository

Ver. 02_05_15

Thank you for participating on our research!

This questionnaire asks you to provide information about various aspects of your background, including your demographic and health information. Please answer the questions by placing an X in the appropriate box.

Published documents regarding these answers will not identify individuals with their answers. However, if there is a question that you do not wish to answer, please leave it blank and go on to the next question.

Demographic Information

1. Gender: ☐$_1$ Male ☐$_2$ Female

2. What is your date of birth? _____ (mm/dd/yyyy)

3. Are you fluent in English? ☐$_1$ Yes ☐$_2$ No

4. What is your preferred language for communicating?

☐$_1$ English
☐$_2$ Spanish
☐$_3$ American Sign Language
☐$_4$ Other (please list)_____

5. What is your highest level of education?

☐$_1$ No formal education
☐$_2$ Less than high school graduate
☐$_3$ High school graduate/GED
☐$_4$ Vocational training
☐$_5$ Some or in-progress college/Associate's degree
☐$_6$ Bachelor's degree (BA, BS)
☐$_7$ Master's degree (or other post-graduate training)
☐$_8$ Doctoral degree (PhD, MD, EdD, DDS, JD, etc)
☐$_9$ Do not wish to answer

6. Current marital status (Check **one**)

☐$_1$ Single
☐$_2$ Married
☐$_3$ Separated
☐$_4$ Divorced
☐$_5$ Widowed
☐$_6$ Other (please specify) _____
☐$_7$ Do not wish to answer

7. Do you consider yourself Hispanic or Latino?

☐$_1$ Yes ☐$_2$ No ☐$_3$ Do not wish to answer

8. How would you describe your primary racial group?

- ☐1 American Indian/Alaska Native
- ☐2 Asian
- ☐3 Black or African American
- ☐4 Native Hawaiian or Other Pacific Islander
- ☐5 White
- ☐6 More than one race
- ☐7 Other (please specify) _____
- ☐8 Do not wish to answer

9. In which type of housing do you live?

- ☐1 Single family home
- ☐2 Apartment or Condominium
- ☐3 Assisted living residence
- ☐4 Nursing home residence
- ☐5 Other (please specify) _____
- ☐6 Do not wish to answer

10. Which one of the following BEST describes your living arrangement?

- ☐1 Living alone
- ☐2 Living with your immediate family (i.e., spouse/partner and/or dependent children, or parents if never married)
- ☐3 Living with your adult children
- ☐4 Living with your (or your spouse/partner's) extended family (e.g., parents, siblings, cousins)
- ☐5 Living with roommate(s)
- ☐6 Other (please specify) _____
- ☐7 Do not wish to answer

11. Is your housing or community specifically designed for seniors (i.e., 55 and older)?

☐1 Yes ☐2 No ☐3 Not sure

12. What is your primary mode of transportation? (Check **one**)

- ☐1 Drive myself
- ☐2 A friend or family member drives me
- ☐3 Walk
- ☐4 Bicycle
- ☐5 Taxi
- ☐6 Use transportation service provided by my residence
- ☐7 Use public transportation (e.g., bus, subway, van services)
- ☐8 Other (please specify) _____

13. Which category best describes your yearly household income? Do not give the dollar amount, just check the category.

- ☐1 Less than $25,000
- ☐2 $25,000 - $49,999
- ☐3 $50,000 - $74,999
- ☐4 $75,000 or more
- ☐5 Do not wish to answer
- ☐6 Do not know for certain

Occupational Status

14. What is your primary occupational status? (Check **one**)

- ☐1 Employed full-time Occupation? _____
- ☐2 Employed part-time Occupation? _____
- ☐3 Student
- ☐4 Homemaker
- ☐5 Retired Former occupation? _____ Year retired? _____
- ☐6 On maternity leave, on sick leave, or on disability benefits
- ☐7 Unemployed or temporarily laid off
- ☐8 Other (please specify) _____

Health Information

1. In general, would you say your health is:

☐1	☐2	☐3	☐4	☐5
Poor	Fair	Good	Very good	Excellent

2. Compared to other people your own age, would you say your health is:

☐1	☐2	☐3	☐4	☐5
Poor	Fair	Good	Very good	Excellent

3. How satisfied are you with your present health?

☐1	☐2	☐3	☐4	☐5
Not at all satisfied	Not very satisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Extremely satisfied

4. How often do health problems stand in the way of your doing the things you want to do?

☐1	☐2	☐3	☐4	☐5
Never	Seldom	Sometimes	Often	Always

5. How many different **prescription medications** do you take each day?

_____

6. How many different **over-the-counter medications/supplements** do you take each day?

_____

7. Please indicate if you have ever been told by a health professional that you have any of the following conditions. Check **one** box for each condition.

Condition	Yes$_1$	No$_2$	Do not wish to answer/ Not sure$_3$
a. Alzheimer's Disease			
b. Arthritis			
c. Asthma			
d. Cancer			
e. Cardiac Atrial Fibrillation/ Cardiac Arrhythmia			
f. Chronic Kidney Disease			
g. Chronic Obstructive Pulmonary Disease (COPD)			
h. Coronary Artery Disease/ Coronary Heart Disease			
i. Depression			
j. Diabetes/High Blood Sugar			
k. Heart Failure/ Congestive Heart Failure			
l. High Blood Pressure/Hypertension			
m. High Cholesterol/Hyperlipidemia			
n. Osteoporosis			
o. Overweight			
p. Stroke/Transient Ischemic Attack			
q. Other? (If yes, please list below) _____ _____			

Vision/Hearing/Motor Capabilities

Please describe your vision, in general, by answering the following questions.

1. a. Do you have SERIOUS difficulty seeing, even when wearing glasses or contact lenses?

   ☐$_1$ Yes ☐$_2$ No

   b. If Yes, with one eye or both eyes?

   ☐$_1$ One eye ☐$_2$ Both eyes

2. a. Do you wear glasses or contacts to help you see things at a distance?

   ☐$_1$ Yes ☐$_2$ No

   b. If Yes, can you see well enough to recognize someone across the street when wearing glasses or contact lenses?

   ☐$_1$ Yes ☐$_2$ No ☐$_3$ Not applicable

3. Can you see well enough to recognize someone across the street without wearing glasses or contact lenses?

   ☐$_1$ Yes ☐$_2$ No

4. a. Do you wear glasses or contacts to help you see things close up?

   ☐$_1$ Yes ☐$_2$ No

   b. If Yes, can you see well enough to read newspaper print when wearing glasses or contact lenses?

   ☐$_1$ Yes ☐$_2$ No ☐$_3$ Not applicable

5. Can you see well enough to read newspaper print without wearing glasses or contact lenses?

   ☐$_1$ Yes ☐$_2$ No

APPENDIX B: TECHNOLOGY EXPERIENCE PROFILE

Technology Experience Profile

1. Within the last year, please indicate how much <u>you have used</u> any of the technologies listed below.

		Not sure what it is$_1$	Not used$_2$	Used once$_3$	Used occasionally$_4$	Used frequently$_5$
Communication Technology						
a.	Answering Machine/ Voicemail (e.g., record and retrieve messages)					
b.	Automated Telephone Menu System (e.g., pay bills, refill prescriptions)					
c.	Fax (e.g., receive and send printed documents)					
d.	Mobile Phone (e.g., make and receive calls)					
e.	Text Messaging (e.g., BBM, iMessage, SMS)					
f.	Video Conferencing (e.g., Skype, Facetime)					

		Not sure what it is$_1$	Not used$_2$	Used once$_3$	Used occasionally$_4$	Used frequently$_5$
Computer Technology						
g.	Desktop/Laptop Computer					
h.	Email (e.g., Gmail, Yahoo)					
i.	Photo/Video Software (e.g., editing, organizing; iPhoto, Picture Manager, Photoshop)					
j.	Productivity Software (e.g., Excel, PowerPoint, Quicken, TurboTax, Word)					
k.	Social Networking (e.g., Facebook, MySpace)					
l.	Tablet Computer (e.g., iPad, Touchpad, Zoom)					
Everyday Technology						
m.	Automatic Teller Machine (ATM)					
n.	Photocopier (e.g., Lexmark, Xerox)					
o.	Home Security System (e.g., Ackerman Security System, ADT)					
p.	In-Store Kiosk (e.g., grocery self-checkout, price checker)					
q.	Microwave Oven					
r.	Programmable Device (e.g., coffee maker, thermostat)					

		Not sure what it is$_1$	Not used$_2$	Used once$_3$	Used occasionally$_4$	Used frequently$_5$
Health Technology						
s.	Blood Pressure Monitor (e.g., measure blood pressure)					
t.	Digital Thermometer (e.g., measure temperature)					
u.	Health Management Software (e.g., diet, exercise, keep track of weight)					
v.	Heart Rate Monitor (e.g., measure heart rate, pulse)					
w.	Medication Reminder Device (e.g., schedule electronic alerts)					
x.	Pedometer (e.g., measure walking distance)					
Recreational Technology						
y.	Digital Music Player (e.g., iPod, MP3 player, Zune)					
z.	Digital Photography (e.g., camcorder, camera)					
aa.	Electronic Book Reader (e.g., Kindle, Nook)					
bb.	Gaming Console (e.g., Playstation, Wii, XBox)					
cc.	Online Coupons/ Shopping (e.g., Amazon, Groupon, retail stores)					
dd.	Recording and Playback Device (e.g., Blu-Ray, CD, DVD, DVR, VCR)					

		Not sure what it is$_1$	Not used$_2$	Used once$_3$	Used occasionally$_4$	Used frequently$_5$
Transportation Technology						
ee.	Airline Kiosk (e.g., check in, print boarding pass)					
ff.	Bus Tracker (e.g., check location of buses, estimate time of arrival)					
gg.	Map Software (e.g., get directions, plan routes; Google Maps, MapQuest)					
hh.	Navigation System (e.g., GPS, OnStar)					
ii.	Online Travel Reservation (e.g., airline website, Expedia, Travelocity)					
jj.	Parking Payment System (e.g., exiting lot, paying for space)					

APPENDIX C: DAILY LIVING SELF-EFFICACY SCALE

For each of item please indicate your level of confidence in performing the activity.

How confident are you in performing the following activities?	Not at all Confident									Completely Confident
1. Getting dressed and undressed	1	2	3	4	5	6	7	8	9	10
2. Cleaning the house	1	2	3	4	5	6	7	8	9	10
3. Preparing simple meals	1	2	3	4	5	6	7	8	9	10
4. Bathing	1	2	3	4	5	6	7	8	9	10
5. Shopping	1	2	3	4	5	6	7	8	9	10
6. Going up and down stairs	1	2	3	4	5	6	7	8	9	10
7. Reaching into cabinets and cupboards	1	2	3	4	5	6	7	8	9	10
8. Getting in and out of the chair	1	2	3	4	5	6	7	8	9	10
9. Walking around the neighborhood	1	2	3	4	5	6	7	8	9	10
10. Hurrying to answer the phone	1	2	3	4	5	6	7	8	9	10

APPENDIX D: ASSISTANCE RECEIVED QUESTIONNIARE

For each task, please indicate:

1) How much assistance you receive for the task?
2) For tasks that you receive assistance, who assists with the task?
3) And how frequently you receive assistance?

1. a. How much assistance you receive with bathing (e.g., getting in and out of tub or shower)?

   ☐$_1$ None
   ☐$_2$ Some
   ☐$_3$ A lot
   ☐$_4$ Total

   b. If you receive assistance (some or a lot), who assists with the task?

   ☐$_1$ Family
   ☐$_2$ Friend
   ☐$_3$ Professional
   ☐$_4$ Other_____

   c. If you receive assistance (some or a lot), how often do you receive assistance?

   ☐$_1$ _____days per month
   or
   ☐$_2$_____days per week

2. a. How much assistance you receive with dressing (e.g., help with putting clothes on self)?

   ☐$_1$ None
   ☐$_2$ Some
   ☐$_3$ A lot
   ☐$_4$ Total

   b. If you receive assistance (some or a lot), who assists with the task?

   ☐$_1$ Family
   ☐$_2$ Friend
   ☐$_3$ Professional
   ☐$_4$ Other_____

   c. If you receive assistance (some or a lot), how often do you receive assistance?

   ☐$_1$ _____days per month
   or
   ☐$_2$_____days per week

3. a. How much assistance you receive with toileting (e.g., cleaning self or transferring to the toilet)?

☐$_1$ None
☐$_2$ Some
☐$_3$ A lot
☐$_4$ Total

b. If you receive assistance (some or a lot), who assists with the task?

☐$_1$ Family
☐$_2$ Friend
☐$_3$ Professional
☐$_4$ Other_____

c. If you receive assistance (some or a lot), how often do you receive assistance?

☐$_1$ _____days per month
or
☐$_2$_____days per week

4. a. How much assistance you receive with transferring (e.g., moving from bed to chair)?

☐$_1$ None
☐$_2$ Some
☐$_3$ A lot
☐$_4$ Total

b. If you receive assistance (some or a lot), who assists with the task?

☐$_1$ Family
☐$_2$ Friend
☐$_3$ Professional
☐$_4$ Other_____

c. If you receive assistance (some or a lot), how often do you receive assistance?

☐$_1$ _____days per month
or
☐$_2$_____days per week

5. a. How much assistance you receive with feeding (e.g., get food from plate to your mouth)?

☐$_1$ None
☐$_2$ Some
☐$_3$ A lot
☐$_4$ Total

b. If you receive assistance (some or a lot), who assists with the task?

☐$_1$ Family
☐$_2$ Friend
☐$_3$ Professional
☐$_4$ Other_____

c. If you receive assistance (some or a lot), how often do you receive assistance?

☐$_1$ _____days per month
or
☐$_2$_____days per week

6. a. How much assistance you receive with telephone use (e.g., operate telephone and dial numbers)?

☐$_1$ None
☐$_2$ Some
☐$_3$ A lot
☐$_4$ Total

b. If you receive assistance (some or a lot), who assists with the task?

☐$_1$ Family
☐$_2$ Friend
☐$_3$ Professional
☐$_4$ Other_____

c. If you receive assistance (some or a lot), how often do you receive assistance?

☐$_1$ _____days per month
or
☐$_2$_____days per week

7. a. How much assistance you receive with shopping (take care of your shopping needs)?

☐$_1$ None
☐$_2$ Some
☐$_3$ A lot
☐$_4$ Total

b. If you receive assistance (some or a lot), who assists with the task?

☐$_1$ Family
☐$_2$ Friend
☐$_3$ Professional
☐$_4$ Other_____

c. If you receive assistance (some or a lot), how often do you receive assistance?

☐$_1$ _____days per month
or
☐$_2$_____days per week

8. a. How much assistance you receive with food preparation (e.g., plan and prepare meals)?

☐$_1$ None
☐$_2$ Some
☐$_3$ A lot
☐$_4$ Total

b. If you receive assistance (some or a lot), who assists with the task?

☐$_1$ Family
☐$_2$ Friend
☐$_3$ Professional
☐$_4$ Other_____

c. If you receive assistance (some or a lot), how often do you receive assistance?

☐$_1$ _____days per month
or
☐$_2$_____days per week

9. a. How much assistance you receive with housekeeping (e.g., dish washing or making bed)?

☐$_1$ None
☐$_2$ Some
☐$_3$ A lot
☐$_4$ Total

b. If you receive assistance (some or a lot), who assists with the task?

☐$_1$ Family
☐$_2$ Friend
☐$_3$ Professional
☐$_4$ Other_____

c. If you receive assistance (some or a lot), how often do you receive assistance?

☐$_1$ _____days per month
or
☐$_2$_____days per week

10. a. How much assistance you receive with laundry (e.g., personal laundry)?

☐$_1$ None
☐$_2$ Some
☐$_3$ A lot
☐$_4$ Total

b. If you receive assistance (some or a lot), who assists with the task?

☐$_1$ Family
☐$_2$ Friend
☐$_3$ Professional
☐$_4$ Other_____

c. If you receive assistance (some or a lot), how often do you receive assistance?

☐$_1$ _____days per month
or
☐$_2$_____days per week

11. a. How much assistance you receive with transportation (e.g., driving car or taking public transportation)?

☐$_1$ None
☐$_2$ Some
☐$_3$ A lot
☐$_4$ Total

b. If you receive assistance (some or a lot), who assists with the task?

☐$_1$ Family
☐$_2$ Friend
☐$_3$ Professional
☐$_4$ Other_____

c. If you receive assistance (some or a lot), how often do you receive assistance?

☐$_1$ _____days per month
or
☐$_2$_____days per week

12. a. How much assistance you receive with medication (e.g., taking right medicine at correct time)?

☐$_1$ None
☐$_2$ Some
☐$_3$ A lot
☐$_4$ Total

b. If you receive assistance (some or a lot), who assists with the task?

☐$_1$ Family
☐$_2$ Friend
☐$_3$ Professional
☐$_4$ Other_____

c. If you receive assistance (some or a lot), how often do you receive assistance?

☐$_1$ _____days per month
or
☐$_2$_____days per week

APPENDIX E: FORMAL CAREGIVER EXPERIENCE QUESTIONNAIRE

Please answer the following questions about your level of experience with a formal caregiver (someone who assists you with care tasks who is not a family member or friend).

1. Have you ever received any assistance from a formal caregiver?
   - ☐$_1$ Yes
   - ☐$_2$ No

2. On average, how many days per week (1-7) did/do you receive assistance from a caregiver?
   - ☐ _____
   - ☐$_{99}$ Do not wish to answer

3. When you receive(d) assistance, on average, how long did/does the caregiver stay and assist you each time?
   - ☐$_1$ Less than 1 hour
   - ☐$_2$ 1-3 hours
   - ☐$_3$ 4-6 hours
   - ☐$_4$ 6-12 hours
   - ☐$_5$ 12-24 hours
   - ☐$_6$ Live in assistant
   - ☐$_7$ Other (please specify) _____
   - ☐$_{99}$ Do not wish to answer

4. How long have you (or did you) receive(d) assistance from a caregiver?
   - ☐$_1$ Less than 3 month
   - ☐$_2$ 3-6 months
   - ☐$_3$ 7-12 months
   - ☐$_4$ 1-3 years
   - ☐$_5$ Over 3 years
   - ☐$_6$ Other (please specify) _____
   - ☐$_{99}$ Do not wish to answer

5. Have you ever hired a formal caregiver?
   - ☐$_1$ Yes
   - ☐$_2$ No

[Please Turn Over]

a. If yes, what resources did you use to hire a caregiver?

- ☐1 Home Care Agency
- ☐2 Family member
- ☐3 Referred by a friend
- ☐4 Personally selected
- ☐5 Independent Living Centers
- ☐6 Vocational Rehab
- ☐7 Online Job Sites (e.g., Craigslist, Care.com)
- ☐8 Other (please list)_____
- ☐99 Do not wish to answer

6. Do you live in an assisted living facility?
   - ☐1 Yes
   - ☐2 No

   a. If yes, how long have you lived in assisted living?
      - ☐1 Less than 3 month
      - ☐2 3-6 months
      - ☐3 7-12 months
      - ☐4 1-3 years
      - ☐5 Over 3 years
      - ☐6 Other (please specify) _____
      - ☐99 Do not wish to answer

APPENDIX F: TEN-ITEM PERSONALITY INVENTORY

Participant ID:_____

We are interested in how you would describe the ideal caregiver you would want. There are no right or wrong answers. We would like you to take your time and read each statement carefully, selecting the response that best describes how you would want your formal caregiver to be.

Disagree Strongly	Disagree Moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree Moderately	Agree Strongly
1	2	3	4	5	6	7

I would want my caregiver to be:

1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative.

APPENDIX G: PROPENSITY TO TRUST SCALE

For each item, please rate how accurately the phrase describes you.

How accurately does this item describe you?	Strongly Inaccurate					Strongly Accurate
1. Listen to my conscience	1	2	3	4	5	6
2. Anticipate the needs of others	1	2	3	4	5	6
3. Respect others	1	2	3	4	5	6
4. Can get along with people	1	2	3	4	5	6
5. Have always been completely fair to others	1	2	3	4	5	6
6. Stick to the rules	1	2	3	4	5	6
7. Believe that laws should be strictly enforced	1	2	3	4	5	6
8. Have a good word for everyone	1	2	3	4	5	6
9. Value cooperation over competition	1	2	3	4	5	6
10. Return extra change when a cashier makes a mistake	1	2	3	4	5	6
11. Would never cheat on my taxes	1	2	3	4	5	6
12. Follow through with my plans	1	2	3	4	5	6

How accurately does this item describe you?	Strongly Inaccurate					Strongly Accurate
13. Believe that people are basically moral	1	2	3	4	5	6
14. Finish what I start	1	2	3	4	5	6
15. Retreat from others	1	2	3	4	5	6
16. Am filled with doubts about things	1	2	3	4	5	6
17. Feel short-changed in life	1	2	3	4	5	6
18. Avoid contacts with others	1	2	3	4	5	6
19. Believe that most people would lie to get ahead	1	2	3	4	5	6
20. Find it hard to forgive others	1	2	3	4	5	6
21. Believe that people seldom tell you the whole story	1	2	3	4	5	6

APPENDIX H: IMPORTANCE OF DIMENSIONS OF TRUST BY TASK QUESTIONNAIRE

Participant ID_____

CAREGIVER AND BATHING

For each item please indicate the level of importance of each attribute for the task of Bathing. This will include the caregiver helping you remove your clothes and physically helping you bathe.

How important are each of these items for you to trust the caregiver with bathing?	Not at all Important			Neutral			Extremely Important
1. Ability	1	2	3	4	5	6	7
2. Communication	1	2	3	4	5	6	7
3. Reliability	1	2	3	4	5	6	7
4. Appearance	1	2	3	4	5	6	7
5. Precision	1	2	3	4	5	6	7
6. Has the same values as you	1	2	3	4	5	6	7
7. Predictability	1	2	3	4	5	6	7
8. Primary intent for performing tasks is wanting to do good for you	1	2	3	4	5	6	7

CAREGIVER AND MEDICATION ASSISTANCE

For each item please indicate the level of importance of each attribute for the task of Medication Assistance. This means the caregiver would help remind you to take medications at the appropriate time and perhaps bring the medication bottle to you.

How important are each of these items for you to trust the caregiver with medication assistance?	Not at all Important			Neutral			Extremely Important
1. Ability	1	2	3	4	5	6	7
2. Communication	1	2	3	4	5	6	7
3. Reliability	1	2	3	4	5	6	7
4. Appearance	1	2	3	4	5	6	7
5. Precision	1	2	3	4	5	6	7
6. Has the same values as you	1	2	3	4	5	6	7
7. Predictability	1	2	3	4	5	6	7
8. Primary intent for performing tasks is wanting to do good for you	1	2	3	4	5	6	7

CAREGIVER AND TRANSFERRING

For each item please indicate the level of importance of each attribute for the task of Transferring. This will include the caregiver helping you sit up, lifting you, and moving you to a wheelchair.

How important are each of these items for you to trust the caregiver with transferring?	Not at all Important			Neutral			Extremely Important
1. Ability	1	2	3	4	5	6	7
2. Communication	1	2	3	4	5	6	7
3. Reliability	1	2	3	4	5	6	7
4. Appearance	1	2	3	4	5	6	7
5. Precision	1	2	3	4	5	6	7
6. Has the same values as you	1	2	3	4	5	6	7
7. Predictability	1	2	3	4	5	6	7
8. Primary intent for performing tasks is wanting to do good for you	1	2	3	4	5	6	7

CAREGIVER AND HOUSEHOLD TASKS

For each item please indicate the level of importance of each attribute for the task of Household Tasks. This will include the caregiver helping plan and prepare meals and doing some light housework such as laundry, doing the dishes, or making the bed.

How important are each of these items for you to trust the caregiver with household tasks?	Not at all Important			Neutral			Extremely Important
1. Ability	1	2	3	4	5	6	7
2. Communication	1	2	3	4	5	6	7
3. Reliability	1	2	3	4	5	6	7
4. Appearance	1	2	3	4	5	6	7
5. Precision	1	2	3	4	5	6	7
6. Has the same values as you	1	2	3	4	5	6	7
7. Predictability	1	2	3	4	5	6	7
8. Primary intent for performing tasks is wanting to do good for you	1	2	3	4	5	6	7

Participant ID_____

ROBOT AND BATHING

For each item please indicate the level of importance of each attribute for the task of Bathing. This will include the robot helping you remove your clothes and physically helping you bathe.

How important are each of these items for you to trust the robot with bathing?	Not at all Important			Neutral			Extremely Important
1. Ability	1	2	3	4	5	6	7
2. Communication	1	2	3	4	5	6	7
3. Reliability	1	2	3	4	5	6	7
4. Appearance	1	2	3	4	5	6	7
5. Precision	1	2	3	4	5	6	7
6. Has the same values as you	1	2	3	4	5	6	7
7. Predictability	1	2	3	4	5	6	7
8. Primary intent for performing tasks is wanting to do good for you	1	2	3	4	5	6	7

ROBOT AND MEDICATION ASSISTANCE

For each item please indicate the level of importance of each attribute for the task of Medication Assistance. This means the robot would help remind you to take medications at the appropriate time and perhaps bring the medication bottle to you.

How important are each of these items for you to trust the robot with medication assistance?	Not at all Important			Neutral			Extremely Important
1. Ability	1	2	3	4	5	6	7
2. Communication	1	2	3	4	5	6	7
3. Reliability	1	2	3	4	5	6	7
4. Appearance	1	2	3	4	5	6	7
5. Precision	1	2	3	4	5	6	7
6. Has the same values as you	1	2	3	4	5	6	7
7. Predictability	1	2	3	4	5	6	7
8. Primary intent for performing tasks is wanting to do good for you	1	2	3	4	5	6	7

ROBOT AND TRANSFERRING

For each item please indicate the level of importance of each attribute for the task of Transferring. This will include the robot helping you sit up, lifting you, and moving you to a wheelchair.

How important are each of these items for you to trust the robot with transferring?	Not at all Important			Neutral			Extremely Important
1. Ability	1	2	3	4	5	6	7
2. Communication	1	2	3	4	5	6	7
3. Reliability	1	2	3	4	5	6	7
4. Appearance	1	2	3	4	5	6	7
5. Precision	1	2	3	4	5	6	7
6. Has the same values as you	1	2	3	4	5	6	7
7. Predictability	1	2	3	4	5	6	7
8. Primary intent for performing tasks is wanting to do good for you	1	2	3	4	5	6	7

ROBOT AND HOUSEHOLD TASKS

For each item please indicate the level of importance of each attribute for the task of Household Tasks. This will include the robot helping plan and prepare meals and doing some light housework such as laundry, doing the dishes, or making the bed.

How important are each of these items for you to trust the robot with household tasks?	Not at all Important			Neutral			Extremely Important
1. Ability	1	2	3	4	5	6	7
2. Communication	1	2	3	4	5	6	7
3. Reliability	1	2	3	4	5	6	7
4. Appearance	1	2	3	4	5	6	7
5. Precision	1	2	3	4	5	6	7
6. Has the same values as you	1	2	3	4	5	6	7
7. Predictability	1	2	3	4	5	6	7
8. Primary intent for performing tasks is wanting to do good for you	1	2	3	4	5	6	7

APPENDIX I: TEN ITEM PERSONALITY INVENTORY FOR CARE PROVIDERS

Participant ID:_____

We are interested in how you would describe the <u>ideal</u> robot you would want for you to trust them. There are no right or wrong answers. We would like you to take your time and read each statement carefully, selecting the response that best describes how you would want your robot to be.

Disagree Strongly	Disagree Moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree Moderately	Agree Strongly
1	2	3	4	5	6	7

<u>ROBOT</u>

I would want my **<u>robot</u>** to be:

1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative

Participant ID:_____

We are interested in how you would describe the <u>ideal</u> caregiver you would want for you to trust them. There are no right or wrong answers. We would like you to take your time and read each statement carefully, selecting the response that best describes how you would want your caregiver to be.

Disagree Strongly	Disagree Moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree Moderately	Agree Strongly
1	2	3	4	5	6	7

<u>CAREGIVER</u>

I would want my **<u>caregiver t</u>**o be:

1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative.

APPENDIX J: PCA VISUALIZED QUESTIONNAIRE

Please answer the following questions about whether you imagined a specific caregiver when we discussed the different scenarios.

1. When we talked about the caregiver doing various tasks, did you imagine a specific caregiver?

- ☐1 Yes
- ☐2 No

<u>If no</u>, please continue on to next questionnaire.

2. Did you imagine a gender of the caregiver you visualized?

- ☐1 Yes
- ☐2 No

2a. If yes, what gender?

- ☐1 Female
- ☐2 Male

3. Did you imagine an ethnicity of the caregiver?

- ☐1 Yes
- ☐2 No

3a. If yes, what ethnicity?

- ☐1 American Indian/Alaska Native
- ☐2 Asian
- ☐3 Black or African American
- ☐4 Native Hawaiian or Other Pacific Islander
- ☐5 White
- ☐6 More than one race
- ☐7 Other (please specify) _____

4.Did you imagine the caregiver had a specific age?

- ☐1 Yes
- ☐2 No

4a. If yes, what age?

- ☐1 20-29
- ☐2 30-39
- ☐3 40-49
- ☐4 50-59
- ☐5 60-69
- ☐6 70-79
- ☐7 80-89
- ☐8 Other (please specify) _____

[Please Turn Over]

5.Did you imagine a height of the caregiver?

- ☐1 Yes
- ☐2 No

5a. If yes, what height?

- ☐1 Between 4-5 ft
- ☐2 Between 5-6 ft
- ☐3 Between 6-7 ft
- ☐4 Other_____

6. Did you imagine a weight of the robot?

- ☐1 Yes
- ☐2 No

6a. If yes, what weight?

- ☐1 Less than 100 lbs
- ☐2 Between 100-150 lbs
- ☐3 Between 150-200 lbs
- ☐4 More than 200 lbs
- ☐5 Other_____

7. Did the qualities of the caregiver you imagined change for any of the tasks??

- ☐1 Yes
- ☐2 No

7a. If yes, for what tasks? Select all that apply and then describe below.

- ☐1 Bathing
- ☐2 Medication Assistance
- ☐3 Transfer
- ☐4 Household Tasks

Please describe:

APPENDIX K: ROBOT VISUALIZED QUESTIONNAIRE

Please answer the following questions about whether you imagined a specific robot when we discussed the different scenarios.

1. When we talked about the robot doing various tasks, did you imagine a specific robot?
   - ☐1 Yes
   - ☐2 No

     If no, please continue on to next questionnaire.

2. Did you imagine a gender of the robot you imagined?
   - ☐1 Yes
   - ☐2 No

   2a. If yes, what gender?
   - ☐1 Female
   - ☐2 Male

3. Did you imagine an ethnicity of the robot?
   - ☐1 Yes
   - ☐2 No

   3a. If yes, what ethnicity?
   - ☐1 American Indian/Alaska Native
   - ☐2 Asian
   - ☐3 Black or African American
   - ☐4 Native Hawaiian or Other Pacific Islander
   - ☐5 White
   - ☐6 More than one race
   - ☐7 Other (please specify) _____

4.Did you imagine the robot had a specific age?
   - ☐1 Yes
   - ☐2 No

   4a. If yes, what age?
   - ☐1 20-29
   - ☐2 30-39
   - ☐3 40-49
   - ☐4 50-59
   - ☐5 60-69
   - ☐6 70-79
   - ☐7 80-89
   - ☐8 Other (please specify) _____

5.Did you imagine a height of the robot?

☐1 Yes
☐2 No

5a. If yes, what height?

☐1 Shorter than 3 ft (for example: size of a small child)
☐2 Between 3-5 ft (smaller than average adult, but larger than a child)
☐3 Taller than 5 ft (size of an average adult)
☐4 Other_____

6. Did you imagine a weight of the robot?

☐1 Yes
☐2 No

6a. If yes, what weight?

☐1 Less than 100 lbs
☐2 Between 100-150 lbs
☐3 Between 150-200 lbs
☐4 More than 200 lbs
☐5 Other_____

7. Did you imagine a certain kind of robot?

☐1 Yes
☐2 No

7a. If yes, what kind of robot did you visualize?

☐1 Human-like
☐1 Machine-like
☐1 Animal-like
☐1 TV/Movie like
☐1 Other_____

8. Did you imagine the robot had a head?

☐1 Yes
☐2 No

9. Did you imagine the robot had a face?

☐1 Yes
☐2 No

9a. If yes, What features did the face include? (Select all that apply)

☐1 Eyes
☐1 Mouth
☐1 Nose

☐1 Ears
☐1 Other

10. Did the robot have arms?
☐1 Yes
☐2 No

11. Did you imagine the robot moved around?
☐1 Yes
☐2 No

11a. If yes, how did the robot move around?
☐1 Legs and feet
☐2 Wheels
☐3 Treads and tracks
☐4 Other_____

12.Did you imagine the robot had features you could interact with?
☐1 Yes
☐2 No

12a. If yes, what type of interaction features did the robot have?
☐1 Buttons
☐2 Screen
☐3 Other_____

13. Did you imagine the robot being controlled in some way?
☐1 Yes
☐2 No

13a. If yes, how was the robot controlled ? Select all that apply.
☐1 Programmed to do task
☐2 Controlled by you to do task
☐3 Other_____

13b. If you imagined the robot was controlled by you to do tasks, how did you imagine doing so?
☐1 Voice commands or activation
☐2 Interface/input (for example, touch screen or buttons)
☐3 Remote control
☐4 Other_____

14. Did the qualities of robot you imagined change for any of the tasks?

☐1 Yes

☐2 No

14a. If yes, for what tasks? Select all that apply and then describe below.

☐1 Bathing

☐2 Medication Assistance

☐3 Transfer

☐4 Household Tasks

Please desribe:

APPENDIX L: TRUST IN ASSISTANCE QUESTIONNAIRE

Trust in Assistance Checklist

We are interested in learning older adults' preferences for assistance in performing daily living tasks. In particular, we are looking for opinions about **trust** in human assistance and robot assistance. When completing this questionnaire, please **imagine** you need assistance in everyday life with these tasks.

For each of the following tasks, please provide your opinion about:

- Trusting a human more to provide assistance
- No preference
- Trusting a robot more to provide assistance

Assume that the robot could perform the task to the level of a human. Please circle the most appropriate response for your general preference.

1

If I needed assistance with...	If I needed assistance, I would be more likely to…				
	Only trust a human$_1$	Prefer to trust a human$_2$	No preference$_3$	Prefer to trust a robot$_4$	Only trust a robot$_5$
a. **Bathing** (e.g., getting in and out of tub or shower)	1	2	3	4	5
b. **Dressing** (e.g., help with putting clothes on self)	1	2	3	4	5
c. **Toileting** (e.g., cleaning self or transferring to the toilet)	1	2	3	4	5
d. **Transfering** (e.g., moving from bed to chair)	1	2	3	4	5
e. **Feeding** (e.g., get food from plate to your mouth)	1	2	3	4	5
f. **Telephone use** (e.g., operate telephone and dial numbers)	1	2	3	4	5
g. **Shopping** (take care of your shopping needs)	1	2	3	4	5
h. **Food preparation** (e.g., plan and prepare meals)	1	2	3	4	5
i. **Housekeeping** (e.g., dish washing or making bed)	1	2	3	4	5
j. **Laundry** (e.g., personal laundry)	1	2	3	4	5
k. **Transportation** (e.g., driving car or taking public transportation)	1	2	3	4	5
l. **Medication** (e.g., taking right medicine at correct time)	1	2	3	4	5

2

APPENDIX M: ROBOT FAMILIARITY AND USAGE QUESTIONNAIRE

ROBOT FAMILIARITY AND USE QUESTIONNAIRE

For the following robots, please indicate your familiarity in terms of hearing about them, using them, or operating them. Please circle only one option.

Robots	Not sure what this is$_0$	Never heard about, seen, or used this robot$_1$	Have only heard about or seen this robot$_2$	Have used or operated this robot only occasionally$_3$	Have used or operated this robot frequently
1. Autonomous Car	0	1	2	3	4
2. Domestic/Home robot (e.g., Roomba)	0	1	2	3	4
3. Entertainment/toy robot (e.g., Aibo, Furby)	0	1	2	3	4
4. Manufacturing robot (e.g., robotic arm in factory)	0	1	2	3	4
5. Military Robot (e.g., search and rescue)	0	1	2	3	4
6. Personal Robot 2 (PR2)	0	1	2	3	4
7. Remote presence robot (e.g., Texai, Anybot)	0	1	2	3	4
8. Research robot (e.g., at university or company)	0	1	2	3	4
9. Robot lawn mower	0	1	2	3	4
10. Robot security guard	0	1	2	3	4
11. Space exploration robot (e.g., Mars Rover)	0	1	2	3	4
12. Surgical robot (e.g., da Vinci Surgical System)	0	1	2	3	4
13. Unmanned Aerial Vehicle (UAV)/Drone	0	1	2	3	4

APPENDIX N: ROBOT SELF-EFFICACY SCALE

For each of item please indicate your level of confidence in using a robot.

I could use a robot to perform a task…	Not at all Confident						Completely Confident
1. …if there was no one around to tell me what to do.	1	2	3	4	5	6	7
2. …if I had only the robot manuals for reference	1	2	3	4	5	6	7
3. …if someone else showed me how to do it first.	1	2	3	4	5	6	7

APPENDIX O: STRUCTURED INTERVIEW

DRAFT

Understanding Older Adult and Care Provider Relationships
Interview Script

General Introduction

Hello <participant name> Thank you for participating in this study. Before we get started I would like you to please turn off your cell phone, so we do not have any interruptions. Thank you.

My name is Rachel Stuck, and I work as a researcher at Georgia Tech. I am a graduate student, and this research is for my Master's thesis. To begin, I would like to review the consent form and the other questionnaires you received in the mail. Did you have any problems completing any of the questionnaires?

<Confirm that consent form is initialed and signed and questionnaires are completed>

To start, I want to review a few key points from the study consent form, which you have already reviewed and signed. As a reminder, your participation is voluntarily, and you can stop at any time. Also, your results will be kept confidential and we will never identify your data by your name. Additionally, we will be audio recording this interview so that we can transcribe your responses and revisit them later. Do you have any questions before we begin?

Topic and goal

There are 3 parts to this session:

- First, we will complete an ability test.
- Then, we will complete the interview portion. I will read to you a scenario of a specific task and we will discuss what you would need from a care provider to trust that they can perform the task.
- Lastly, I will ask you to fill out questionnaires.

Ability Test

First we are going to do the MoCA. <Administer MoCA>

Now we will move on to the interview portion of the study, which will be audio recorded. There is no rush for any of these questions. Our session will take approximately 1 hour. It is ok to get up during the session if you need to but there will also be opportunities to take several breaks during the interview. There are no right or wrong answers, so please feel free to express your opinion, whether it is positive or negative. In order to be consistent for all of the participants, I need to read directly from the script. I apologize if the questions sound formal or repetitive. It is okay if your answers overlap.

<START RECORDER>

Icebreaker
Before we begin, I just want to make sure all my equipment is working, so let's start off with a practice question. Can you tell me briefly about your favorite hobby?

<Check the audio recorder to make sure it is working> Great, all of my equipment is working! Now we will continue on to the formal interview.

Formal Caregiver

First, we are going to be discussing your thoughts and opinions on what you would want a formal caregiver to be like for you to trust them to perform a certain tasks and what is needed to sustain this trust. For the purpose of our study, I want you to think of a formal caregiver as someone you selected to help you with these daily living tasks: bathing, medication assistance, transferring and household tasks. For each scenario, I want you to think of what you would need to trust the formal caregiver specifically for that task. Trust is what would make you feel confident and secure in them performing the task.

For the purpose of today:
<Give them card with scenario to look at while you read>

I want you to imagine that you need assistance from a new formal caregiver for various care tasks. Imagine that you are not able to do these tasks on your own and can only complete them with the formal caregiver's help. There is also no one else such as a family member or spouse helping with these tasks. I also want you to imagine that cost is not an issue.

Here is a card for you to refer to that defines what I mean by trust. Do you have any questions about what this definition means?

Now we are going to go through the scenarios and discuss what an ideal formal caregiver would be like for you to trust them to perform the task for each scenario.

Scenarios

Bathing
Imagine you have a caregiver who is going to assist you with bathing. This will include them helping you remove your clothes and physically helping you bathe. For this task,

- What is important to you to be able to trust the caregiver with bathing?
- Next I am going to ask you a few questions to see what is important for you to trust the caregiver assist you bathe.
    - Is their ability, the caregiver's expertise or capability, to perform the task important?
    - What kind of communication between you and the caregiver would bring you to trust them more?
    - Is their reliability, which can be thought of as their consistency in performing the task important?

    - Is their appearance important?
    - Is their precision, which means they perform the task exactly and accurately, important?
    - What role do you think the idea that a person's values are similar to your own plays in trusting a caregiver help you bathe?
    - Is their predictability, which means that they behave in a way you expect them to in the task, important?
  - Is there anything else that would help you to be able to trust them to perform this task?
  - Is there anything that would cause you to not trust them to perform this task?

Next, let's talk about **Medication Assistance**.
Imagine you have a caregiver who is going to assist you with medications. This means they would help remind you to take medications at the appropriate times and perhaps bring the medication bottle to you. For this task,

  - What is important to you to be able to trust the caregiver for medication assistance?
    - Is there anything else that would help you be able to trust them to perform this task?
  - Is there anything that would cause you to not trust them to perform this task?

Now, let's talk about **Transferring**.
Imagine you have a caregiver who is going to assist you with transferring from the bed to a wheelchair. This will include the caregiver helping you sit up, lifting you, and moving you to the wheelchair. For this task,

  - What is important to you to be able to trust the caregiver for transferring?
    - Is there anything else that would help you be able to trust them to perform this task?
  - Is there anything that would cause you to not trust them to perform this task?

Now, let's talk about **Household Tasks**
Imagine you have a caregiver who is going to assist you with household tasks. These tasks will include helping plan and prepare meals and doing some light housework such as laundry, doing the dishes, or making the bed. For this,

  - What is important to you to be able to trust the caregiver for household tasks?
    - Is there anything else that would help you be able to trust them to perform this task?
  - Is there anything that would cause you to not trust them to perform this task?

General
Now, I want you to think about everything we have talked about today and think about a new formal caregiver in general, not specifically for a particular task.

- What would you want to know about a formal caregiver before selecting them?
  - If you could talk to a previous employer of the caregiver, what would you want to ask or know?

- In trust literature, there is a concept called benevolence that is discussed. <Give them definition card> In this context, benevolence is the idea that the formal caregiver is performing the task with the goal of wanting to do good for you. What role do you think this plays in trust in the context of a formal caregiver and older adult?
    - Do you think it would matter less or more based on what task they were performing?
- In general, what would you prefer a formal caregiver to be like?
- In general, what would you prefer a formal caregiver to not be like?

That concludes the portion of our interview that focuses on formal caregivers. Next, we are going to discuss another type of a care provider, a robot.

Robot Caregiver

Now we are going to focus on your thoughts and opinions on what you would want a robot to be like for you to trust them to perform certain tasks, and what is needed to sustain this trust. For the purpose of our study, I want you to think of the robot as something you selected to help you with these daily living tasks: bathing, medication assistance, transferring, and household tasks. For each scenario, I want you to think of what you would need to trust the robot specifically for that task. Trust is what would make you feel confident and secure in the robot performing the task.

Again, I want you to imagine that you need assistance from an assistive robot for various care tasks. Imagine that you are not able to do these tasks on your own and can only complete them with the robot's help. There is also no one else such as a family member or spouse helping with these tasks. I also want you to imagine that cost is not an issue.

Now we are going to go through the scenarios and discuss what an ideal robot would be like for you to trust it to perform the task for each scenario.

Scenarios

Bathing

Imagine you have a robot that is going to assist you with bathing. This will include it helping you remove your clothes and physically helping you bathe.

For this,

- What is important to you to be able to trust the robot for bathing?
- Next I am going to ask you a few questions to see what is important for you to trust the robot to assist you bathe.
    - Is its ability, the robot's expertise or capability, to perform the task important?
    - What kind of communication between you and the robot would bring you to trust it more?
    - Is its reliability, which can be thought of as its consistency in performing the task, important?
    - Is its appearance important?

    - Is their precision, which means it performs the task exactly and accurately, important?
    - What role do you think the idea that a robot's values are similar to your own plays in trusting a robot help you bathe?
    - Is its predictability, which means that the robot behaves in a way you expect them to in the task, important?
  - Is there anything else that would help you to be able to trust the robot to perform this task?
  - Is there anything that would cause you to not trust the robot to perform this task?

Next, let's talk about **Medication Assistance**.
Imagine you have a robot that is going to assist you with medications. This means it would help remind you to take medications at the appropriate time and perhaps bring the medication bottle to you.

For this task,
- What is important to you to be able to trust the robot for medication assistance?
  - Is there anything else that would help you to be able to trust it to perform this task?
- Is there anything that would cause you to not trust the robot to perform this task?

Now, let's talk about **Transferring**.
Imagine you have a robot that is going to assist you with transferring from the bed to a wheelchair. This will include the robot helping you sit up, lifting you, and moving you to the wheelchair.

For this task,
- What is important to you to be able to trust the robot for transferring?
  - Is there anything else that would help you be able to trust it to perform this task?
- Is there anything that would cause you to not trust the robot to perform this task?

Now, let's talk about **Household Tasks**
Imagine you have a robot that is going to assist you with household tasks. These tasks will include helping plan and prepare meals and doing some light housework such as laundry, doing the dishes, or making the bed.

For this task,
- What is important to you to be able to trust the robot for household tasks?
  - Is there anything else that would help you be able to trust it to perform this task?
- Is there anything that would cause you to not trust the robot to perform this task?

Now, I want you to think about everything we have talked about and to think about a robot in general, not specifically for a particular task.

- What would you want to know about a robot before selecting it?
    - If you could talk to someone who had owned the robot previously, what would you want to ask or know?
- In trust literature there is a concept called benevolence that is discussed. <Give them definition card> In this context, benevolence is the idea that the robot is performing the task with the goal of wanting to do good for you. What role do you think this plays in trust in the context of a robot and an older adult?
    - Do you think it would matter less or more based on what task they were performing?
- In general, what would you prefer a robot to be like?
- In general, what would you prefer a robot to not be like?

<STOP RECORDER>

Great, that concludes the interview portion of our session today. Would you like to take a 5-minute break?

Next, I would like you to fill out a variety of questionnaires.
Administer:

Caregiver Visualized Questionnaire
Robot Visualized Questionnaire
Importance of Dimensions of Trust by Task Questionnaire
Care provider TIPI
Robot Usage and Familiarity Questionnaire

Thank you for your time and being a part of our study. Here is your payment for being a part of our research study. <Administer check and have them sign check payment form>

Here is a debriefing form for you to review what you did in our study and why we are conducting this research. This study explored what is needed to sustain trust between older adults and care providers, both formal caregivers and robots. To help understand this, we had you complete several questionnaires, a few abilities tests, and be part of a structured interview. These results will be used to help improve the relationships of older adults and formal caregivers, as well as provide recommendations for the development of care robotics.

APPENDIX P: CODING SCHEME

Code			**Definition**
Care Provider			
	Robot		
	Human		
Task			
	Bathing		
	Medication Assistance		
	Transfer		
	Household Tasks		
Trust Attitude			
	Yes		"I would trust the caregiver."
	No		"I wouldn't trust the caregiver."
Professional Skills			**Definition**
	Attitude Towards Doing Task		does the caregiver appear willing to do the task, are they straightforward about the task, or do they complaining about task
	Ability		
	Capability		
		General Capability	are they able to perform that specific task
		Physical Capability	do they have the physical ability to perform the task
	Training/Education		do they have training specific to the task or specific to caregiving
	Experience		have done the specific task before, have been a caregiver before

	Efficiency		caregiver performs the task in a well-organized or timely manner
	Precision		are they exact and accurate in their performance of the task; do they complete the task thoroughly
	Other		
	Knowledge		
	Procedural		Do they know how the task needs to be done; Do they understand the general health related issues or concerns for the task
	Contextual		do they understand the capabilities and sensitivities of the older adult
	Reliability		
	Consistency		are they consistent in their task performance
	Dependable		are they dependable
	On time		task is done at the appropriate time
	Predictability		the care provider acts in a way that is consistent with the older adults expectations
	Safety		the task is performed with little to no potential to harm the older adult
	Gentleness		do they perform the task gently
	Adaptability		does the care provider adapt the way they perform the task to the method that the

			older adult prefers
	Other		
	Inappropriate Touching/Comments		The caregiver does not touch any areas in a way that the older adult considers inappropriate; caregiver does not mock the participant or make fun of them
Personal Traits			
	Values	*If they mention about how they want the task done, this is just procedural knowledge or general ability, not values	
	Acceptance of Trustor's Values		is the care provider supportive or respectful of the older adult's personal characteristics or preferences
	Congruence of Care Provider Values		do they have the same set of values as them;
	Physical Attributes		
	Gender		they would prefer a male or female
	Body Build		preference for a specific physique
	Ethnicity		they prefer a certain race
	Physical Cleanliness		personal preference for care providers hygiene
	Manner of Dress		is the care provider dressed in a way suitable to the older adult; what they are actually wearing
	Other		
	Dispositions		
	Abusive		are they abusive,

	Benevolence/Kind		are they a caring person/are they doing the task because they care about the older adult
	Punctuality		are they a punctual/timely person
	Patience		care provider accepts delay or trouble without getting angry or upset
	Bossy		care provider is domineering, gives orders and doesn't listen to older adult
	Rude		they are impolite, ill-behaved
	Sense of Humor		care provider is able to perceive humor or joke with older adult
	Intelligent		care provider is intellectual or intelligent
	Other		
	Programmer Qualities		
		Programmer Values	does the programmer have the same set of values as them;
		Programmer Benevolence	does the programmer care about what is best older adult/did they program/design the robot because they care about them
		Other	
	Other		
Communication			
	Content of Communication (What)		
		Task Specific	they explain what they are doing or about to do;

		Personal	talk to them about family, life, joke with them etc.
	Manner of Communication (How)		
		Communicates Clearly	can the older adult understand them and do they understand the older adult
		Responsiveness/Engagement	answers questions, listens to what I am saying and responds appropriately
	Other		
Other			
	Technology Dislike		the older adult general dislike of technology would impact their trust
	Cellphone Use		they would not want the care provider to use the phone and take calls during the task
	Experience with Care provider		the older adult would need to know or have experience with the care provider before trusting
What would you want to know about a care provider before selecting them?			
	Experience/Training		how long have they been working, how much training they have
	Criminal Record		have they been arrested or gone to jail
	Performance/Capability		How well do they perform, are they timely; are they able to perform specific activities

	Personality		are they a caring person etc.
	Other		
If you could talk to a previous employer of the care provider, what would you want to ask or know?			
	Performance		what was their performance like, did they do a good job
	Personality		did they get along with them
	Satisfaction w/ Care Provider		were they happy with the care provider and would they use them again
	Other		
What role do you think this [benevolence] plays in trust in the context of a care provider and older adult?			
	Yes		
	No		
Do you think it would matter less or more based on what task they were performing?			
	Yes		
	No		

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